Bribes vs. Taxes: Market Structure and Incentives*

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Abstract

Firms in developing countries often make informal payments to tax officials. These bribes raise the cost of doing business, and the price charged to consumers. To decrease these costs, we design a feedback incentive scheme for business tax inspectors that rewards them according to the anonymous evaluation submitted by inspected firms. We show theoretically that feedback incentives decrease the bribe size, but make firms facing a more inelastic demand more attractive for inspectors. A tilted scheme that attaches higher weights to the evaluation of smaller firms limits the scope for targeting and decreases the bribe size to a lesser extent. We test both schemes in a field experiment in the Kyrgyz Republic. Our intervention reduces bribes, average cost, and the price firms charge to consumers. Since fewer firms substitute bribes for taxes, tax revenues increase. Our results show that firms pass-through bribes to consumers, and that market structure shapes the relationship between firms and tax officials.

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1 Introduction

Firms in developing countries are routinely asked for bribes. According to the latest available World Bank Enterprise Survey data, 64.7% of firms in Cambodia have experienced at least one bribe payment request, as opposed to 1.9% in Sweden (World Bank 2017). These informal payment or gift requests often come from tax officials. In this case, bribes are not necessarily the result of extortion: firms may be willing to pay bribes to avoid paying taxes. Yet, when regulatory transparency is low, court enforcement is poor, and the bureaucracy is inefficient, tax officials enjoy high bargaining power in their relationship with private firms, micro and small enterprises in particular. This results in high bribe payments that increase the cost of doing business and negatively affect firm entry, exit, and growth. If firms pass through these costs using prices, bribes also decrease consumer welfare. The extent to which this happens will depend on the industrial organization and structure of the market in which the firm operates.

In the environment described above, there is scope for policy interventions that reduce bribe payments by increasing the bargaining power of firms in their relationship with tax officials. Designing these interventions is challenging for several reasons. First, tax authorities in developing countries often lack detailed information on the activity of tax officials and inspectors. This restricts the set of tools that can be used to increase their accountability. The rebalancing of bargaining power needs therefore to come at least partly from a mechanism that relies on the information provided by firms. Second, the mechanism needs to take into account firm heterogeneity. Firms are not all equally willing to engage in bribing relationships, and tax officials internalize this when choosing the target of their actions (Svensson 2003; Olken and Barron 2009). Third, and most importantly, any intervention that manages to lower bribe payments also makes bribing more attractive for those firms at the margin between paying the bribe or complying with the regulation and paying taxes. Bribing could therefore increase on the extensive margin, and tax revenues could decrease.

In this paper, we address these challenges and shed light on these trade-offs by designing and implementing an incentive scheme for business tax inspectors that rewards them based on the anonymous evaluation submitted by inspected firms. The scheme increases the bargaining power of firms in their relationship with tax officials, thus decreasing the bribe amount. We test two variants of this instrument in a field experiment that we ran in collaboration with The World Bank Group and the State Tax Service (STS) of the Kyrgyz Republic. In practice, we survey firms and ask them whether they were inspected by tax officials, and the inspected ones to evaluate the interaction occurred with the inspector on a scale from 0 to 10, where 10 indicates a perfect score. We preventively inform all tax inspectors in treatment areas of the exact scheme, and then pay tax inspectors in each local office a bonus that is linked to the average score submitted by inspected firms.

To inform our intervention design and interpret our findings, we develop a simple model that describes the interaction between firms and inspectors. Firms choose whether to pay taxes or to engage in informal relationships with tax inspectors and pay bribes. Inspectors decide which firms to inspect, and the amount of informal payment requested. Importantly, taxes take the form of a fixed-amount license fee, a common feature of taxation of micro and small enterprises around the world (Engelschalk and Loeprick 2015). In the model, firm heterogeneity shapes the equilibrium bribery outcome. Under feedback incentives, inspectors face a trade-off between extracting bribes and getting high evaluations on behalf of inspected firms. They solve it by targeting more for inspections and bribes those firms for which bribing is less detrimental to profits and thus evaluation: those that can pass through more of the cost of bribes to consumers. The equilibrium bribe payment decreases, while the targeting response makes the effect on tax revenues ambiguous.

These theoretical results informe our intervention, which involves two treatments. In the first one, the bonus paid to inspectors is a piece rate that increases with the average evaluation submitted by inspected firms. Specifically, it rewards inspectors for the improvement in evaluation relative to the pre-intervention average at the local office level. The other treatment is also a piece rate that increases with the improvement in average evaluation, but this average is now weighted, with higher weights attached to the evaluation submitted by smaller firms. The objective of this tilted scheme is to limit the scope for targeting of larger firms on behalf of inspectors while still reducing the bribe amount. The tilted scheme is set up to provide additional evidence of the bribing mechanism highlighted in the model.

We randomly assigned 50 local tax offices and 356 inspectors in the Kyrgyz Republic – covering the entire country – to either one of these two treatment groups, or to a control group. What we find is consistent with the model predictions. First, the average inspected firm under the unweighted piece rate (PR) scheme faces a demand curve that is significantly more inelastic: an indication of larger pass-through. In contrast, we find no evidence of such targeting under the tilted piece rate (PRT) scheme. Second, firms in both treatment arms are inspected less frequently and report lower bribes, significantly so under PRT and PR incentives respectively. Third, inspected firms in both treatment arms report lower average cost and charge lower prices. These effects are again significant only under PR incentives, for which the model indeed predicts a larger decrease in the bribe amount. We interpret this as evidence of pass through of bribes to consumers. Finally, tax revenues increase in both treatment arms, and significantly so under PRT incentives, which is where inspection rates decrease significantly. This is consistent with the hypothesis that inspectors allow firms to substitute bribes for taxes.

Our paper contributes to the literature on corruption, firms, and development. There is an ample debate on the size, costs, and causes of corruption (Olken and Pande 2012). Countries with high levels of corruption have low fiscal capacity and low GDP level and growth (Mauro

1995; Tanzi 1998; Svensson 2005; Besley and Persson 2014). Although substantial progress has been made in measurement, it is still unclear how large the inefficiencies brought by corruption are. In fact, when the bureaucracy is highly dysfunctional, positive levels of corruption can be efficient (Leff 1964; Huntington 1968; Méon and Weill 2010). However, bribe payments typically involve high transaction costs because of their uncertainty and secrecy, and the impossibility of enforcing corrupt contracts in court (Shleifer and Vishny 1993).

For private firms, bribes can be more or less distortionary than taxes depending on whether the resulting effective marginal tax rate is higher or lower. Using survey data from Uganda, Fisman and Svensson (2007) show that one-percentage point increase in the bribery rate is associated with a reduction in firm growth that is about three times greater than that the same increase in tax rate. Sequeira and Djankov (2014) use data on South African firms, and show how firms adapt to different types of corruption by adjusting their transport strategies. Evidence from survey data indicates that firms are willing to incur in higher transport costs to avoid the uncertainty associated with illicit payments. Svensson (2003) investigates the determinants of bribing among firms. He finds that variation in policies and regulations across industries correlates significantly with the incidence of bribes. He also finds that, within sectors, current and expected future profitability and estimated alternative return on capital can explain a large part of the variation in bribes across firms. Olken and Barron (2009) use originally collected data on illegal payments made by Indonesian truck drivers to show how the market structure of the bureaucracy affects the amount of bribes charged. They also find that corrupt officials adopt complex pricing schemes.

Our results are consistent with these studies in showing how firm heterogeneity shapes the informal relationships between firms and tax officials. We highlight the role of pass-through of bribes to consumers using prices, showing direct evidence that tax inspectors strategically take this margin into account in their activity. In doing this, we also contribute to the debate on the efficiency cost of corruption (Bardhan 1997). The more corruption affects firms with larger pass-through the more consumer welfare decreases. Moreover, these firms typically serve poorer people as they are located in less competitive and more remote locations where the poor are more likely to live.

Consistent with the theoretical work of Shleifer and Vishny (1993) and Mookherjee and Das-Gupta (1998), the results in Olken and Barron (2009) also suggest that changing the organization of the bureaucracy and increasing its efficiency is key to address corruption. However, that is typically hard to do. In environments with poor enforcement, simply increasing tax inspectors' wages may improve the bargaining position of officials and lead to higher bribes (Mookherjee and Png 1995). A different approach is to reward inspectors according to the amount of tax revenues they generate ("tax farming"). Khan, Khwaja, and Olken (2016) design and evaluate such incentive scheme for property tax inspectors. By linking their salary to

the amount of taxes they collect, the scheme increases the bargaining power of tax inspectors, which leads to the disruption of some informal agreements between taxpayers and inspectors. As a result, tax revenues increase. However, most taxpayers report no change in tax paid, and higher and more frequent bribes. Khan, Khwaja, and Olken (2016) also experiment with a scheme that rewards inspectors according to both the amount of tax revenues they generate and reported taxpayer satisfaction and accuracy of tax assessments. They find the positive impact on tax revenues to be lower in this case, while customer satisfaction and quality perceptions increase slightly.

There are several important differences between our paper and Khan, Khwaja, and Olken (2016), which make the two studies complementary. First, we focus on business taxation and on how firm heterogeneity and market structure shape the equilibrium response to incentives. Second, our primary objective is to decrease bribes, which can increase the cost of doing business, limit firm entry, dampen firm growth, and hurt consumers through higher prices. The feedback incentive scheme we propose achieves this goal by increasing the bargaining power of firms, with no negative impact on tax revenues.

More generally, our study contributes to a growing literature in development economics that studies the organization of the bureaucracy, incentives and selection of public sector workers in developing countries (Dal Bó, Finan, and Rossi 2013; Ashraf, Bandiera, and Jack 2014; Finan, Olken, and Pande 2015; Rasul and Rogger 2016; Best, Hjort, and Szakonyi 2017).

The remainder of the paper is organized as follows. Section 2 describes the main features of business taxation in the Kyrgyz Republic and the setting of our intervention. Section 3 presents the theoretical model. Section 4 introduces our sampling strategy and data, while Section 5 shows descriptive evidence in support of the model. Sections 6 and 7 discuss our main intervention and results. Section 8 concludes.

2 Business Taxation in the Kyrgyz Republic

The Kyrgyz Republic is a landlocked, largely mountainous, lower-middle income country located in central Asia. It has a population of 6 million, and a GDP per capita of approximately 1,100USD. A former Soviet Republic, it became a sovereign state in 1991. Its democratic political system is plagued by instability, largely due to ethnic and political conflict. Weak governance and entrenched corruption are among the most relevant barriers to the country's growth (World Bank 2017).

Tax collection and administration are managed by the State Tax Service (STS). Business tax payers are classified in four main categories: VAT payers, single tax payers, license holders, and contract holders. Businesses with turnover exceeding 4 million Soms (approximately

60,000 USD) are mandated to register as *VAT payers*. Individual entrepreneurs not exceeding the VAT threshold can opt to enter a simplified tax regime, which is composed of the two categories of single tax payers and license holders. *Single tax payers* need to fill a yearly tax declaration, and pay a single tax which is a percentage of declared revenues. A subset of those businesses who qualify for the simplified regime can opt to be *license holders*. On top of the requirements to enter the simplified tax regime (i.e., being below the VAT threshold and being individual entrepreneurs), a business applying for being a license holder needs to fulfill additional requirements related to the sector of activity, turnover, and physical space (in squared feet) occupied by its facilities. The license holder purchases a license, which can last one month or one quarter. The license gives the holder the right to carry out a specific economic activity during the period for which the license is valid. The license cost is the only transfer the business makes to the tax authority. The cost of licenses varies between 7 and 210 USD approximately, depending on sector of activity, size of the business, and its location. The last category of business taxpayer is the one of *contract holders*. Businesses in this category stipulate a contract with STS which states the amount of taxes (in level) they will pay in the upcoming years. STS reserves itself the right to unilaterally adjust this amount. Requirements to enter this regime are related to the time elapsed since the start of the business, with requirements varying by sector.

The STS operates at the local level with 59 local tax offices. Local officers are responsible for tax collection and inspections. Inspections are divided in two categories: the visiting inspection and the raid inspection. *Visiting inspections* are carried out by a team of officers and can last several days in which the team goes through the accounting books of the company. The businesses target for visiting inspection are selected according to an automated algorithm which combines several criteria, one of them being VAT liquidation. Hence, VAT payers are the most affected by this type of inspection. *Raid inspections* are instead typically performed by a single officer. The officer has full discretionary power in deciding whether and when to visit a given business. During a raid inspection, the inspector typically checks whether the business complies with the tax regulation, and rarely goes through the accounting books. According to STS data, raid inspections target disproportionally more individual entrepreneurs.

Our population of interest is the one of individual entrepreneurs operating under the simplified tax regime. Most of them are license holders or fulfill the requirements to enter this regime. These are micro and small enterprises with low bargaining power when dealing with tax inspectors. They are also disproportionally more targeted by raid inspections, where officials have full discretionary power in choosing the target. We expect the incidence of informal agreements with tax inspectors to be higher in this population.

3 The Model

Inspectors choose which firm to inspect, and the amount of informal payment requested. In doing this, they take into account the choice of the firms to pay taxes or to engage in informal relationships with inspectors. Firm heterogeneity shapes the firms' willingness to substitute bribes for taxes and the equilibrium behavior of inspectors along both the extensive (whether to collect a bribe) and intensive (the size of the bribe) margins. We formalize this environment using a simple theoretical model. The model helps to clarify how a specific dimension of firm heterogeneity – the elasticity of the demand they face and, accordingly, the extent of pass-through – affects the inspectors' response to feedback incentives, and how to incorporate these issues in the design of our intervention.

Consider a continuum of firms, all with marginal cost $c \geq 1$. Each firm operates under monopolistic competition, each one of them having a different degree of product differentiation. It follows that each one of them faces an iso-elastic demand curve $q(p) = p^{-r}$, with $r > 1$. The elasticity r of the demand they face is the only dimension of heterogeneity across firms. In Appendix A.2.1, we investigate other possible dimensions of firm heterogeneity such as marginal and fixed costs and show that they do not confound our main theoretical and empirical results.

Firms comply with the regulation if they pay taxes equal to τ. In our setting, and given the focus on individual entrepreneurs and license holders, τ represents the license fee and is therefore a fixed cost. As mentioned above, the requirement of a fixed-amount license fee is a common feature of business taxation of micro and small enterprises around the world (Engelschalk and Loeprick 2015). When paying taxes, firm profits are given by

$$\pi = (p - c)q(p) - \tau = (p - c)p^{-r} - \tau. \tag{1}$$

The firm chooses the price p that maximizes profits, i.e.

$$\begin{aligned} p^* &= \frac{r}{r-1}c \\ \pi^* &= \left[\frac{c}{r-1}\right]^{1-r} r^{-r} - \tau \end{aligned} \tag{2}$$

Under monopolistic competition, the price equals a fixed mark up over marginal cost.

The timing of the model is as follows. In the first stage, production takes place, and each firm chooses whether to comply with the regulation and pay taxes. In the second stage, non-compliant firms that are inspected can pay a bribe B as a transfer to the tax inspector. When

paying bribes, firm profits are equal to

$$\pi = (p - c)q(p) - B \tag{3}$$

For the inspector, the utility cost of a single visit is fixed and equal to δ. If an agreement is reached between the firm and the inspector, the latter receives a payoff of $B - \delta$. If the agreement is not reached, the inspector receives a payoff of $-\delta$ and shuts down the business. The firm loses its revenues together with the cost of production $cq(p)$ incurred in the first stage.

The joint surplus from the agreement is equal to the firm's revenues $pq(p)$. The bribe paid is such that the payoff of each side is equal to their outside option plus their share of surplus. Let the inspector's share of surplus be equal to b. It follows that

$$B = bpq(p) \tag{4}$$

The bribe is proportional to firm revenues. Inspectors price discriminate and charge higher bribes to firms with higher revenues. Unlike in the standard Nash bargaining protocol, we let the inspector choose unilaterally the share of surplus and thus the bribe rate b that maximizes her utility. Without loss of generality, we assume that b is constant across firms. As we explain below, allowing b to vary optimally with r does not change the predictions of the theoretical model and their implications for intervention design.[1]

Firms and inspectors play repeatedly. At each iteration, firms move first and make tax compliance and production decisions. Subsequently, non-compliant firms are visited by inspectors and engage in informal relationships with them. Finally, pricing decisions are made, goods are sold in the market and revenues are realized. As such, the model provides an accurate description of the environment we operate in, where licenses need to be renewed on a regular basis and inspectors visit firms frequently.[2] Among the equilibria of this infinitely repeated game, we select those in which the bribe rate b is constant over time. Firms incorporate the inspector's

[1] Section 5 provides direct evidence that the relative amount of bribes as share of revenues is indeed constant across revenue categories in our sample and equal to 3%. In contrast, Bai, Jayachandran, Malesky, and Olken (2017) use data from the World Bank Enterprise Survey and Vietnamese firm-level data to show that the share going to bribes decreases with revenues. They rationalize this finding in a model where regional governments compete with each other to attract and retain firms, and the threat of firm relocation induces bureaucrats to charge lower bribe rates on larger firms. However, the average number of employees for in their sample is over 19 as opposed to 3 in our data. Similarly, the latest available World Bank Enterprise Survey data from the Kyrgyz Republic include only 5% of firms with less than 5 employees, while these are 92% of the firms in our sample. We argue that the mechanism they put forward is unlikely to operate among the very small firms that constitute our population of interest and sample. Moreover, evidence shows that almost all firms in developing countries have fewer than 10 employees (McKenzie 2017).

[2] As we discuss in Section 4, 74% of businesses in our baseline sample report to have been inspected at least once over the last year. Of those inspected more than once, more than 70% report to have been visited by different inspectors. This supports the choice of not modeling heterogeneity among inspectors and rather focus on the behavior of a hypothetical representative inspector. Furthermore, our feedback intervention could only be implemented at the office level.

equilibrium bribe rate decision in their production choices, and inspectors take into account the impact that bribes have on firms' production and pricing decisions.

Substituting equation 4 in equation 3, we can rewrite firm's profits as

$$\pi = [(1-b)p - c]q(p) = [(1-b)p - c]p^{-r} \tag{5}$$

Maximization yields

$$\begin{aligned} \tilde{p} &= \frac{r}{r-1}\frac{c}{1-b} \\ \tilde{\pi} &= \left[\frac{c}{r-1}\right]^{1-r}\left[\frac{r}{1-b}\right]^{-r} \end{aligned} \tag{6}$$

Notice that $\partial\tilde{p}/\partial b > 0$. The higher the bribe rate b the higher the price $\tilde{p}$: firms pass through bribes to consumers. Also, the amount of pass-through is higher for firms facing a more inelastic demand, as $\partial^2\tilde{p}/\partial b\partial r < 0$.

The firm chooses in the first stage not to comply with the regulation whenever it is profitable to do so, meaning $\tilde{\pi} \geq \pi^*$. Lower taxes and a higher bribe rate make the firm less willing to substitute bribes for taxes. Bribes are proportional to revenues, while the license fee acts as a fixed cost. It follows that firms facing a more inelastic demand are less willing to substitute bribes for taxes. Yet, these firms can pass through more of the cost of bribes to consumers, with relatively lower impact on their profits.

3.1 Inspector's Payoff and Equilibrium With No Incentives

In the baseline scenario with no feedback incentives, the tax inspector earns a fixed wage w. She also collects bribes B from those firms who are willing to substitute bribes for taxes, with the utility cost of a single visit being equal to δ. The inspector's overall payoff is given by

$$u = w + \int_R B(b,r)dr - \delta|R| \tag{7}$$

where R is the set of visited firms. Notice that, in the model, the only purpose of an inspector's visit is to engage in an informal relationship with the firm and get the corresponding bribe. Inspectors are neither rewarded nor punished based on tax revenues or tax compliance on behalf of the firm. Abstracting from these issues allows us to model the bribing relationship between inspectors and firms in the most parsimonious way. Most importantly, this is a good approximation of the environment we are interested in, characterized by low accountability, inefficient organization in the bureaucracy, and poor enforcement.

The equilibrium is defined by a bribe rate b^* and a set of firms R^* such that (i) all firms in R^*

are willing to substitute bribes for taxes and are visited by the inspector, and (ii) the inspector maximizes her own utility. Figure 1 shows a graphical representation of the model and its equilibrium for given values of τ and δ. The blue continuous line shows how the net benefits of bribing on behalf of the firm change with demand elasticity r. The set of firms that are willing to substitute bribes for taxes are all those for which net benefits are positive. However, since visiting firms is costly, only a subset of these firms are visited by the inspector in equilibrium. The green dashed line shows the net payoff for the inspector. Inspectors find worth visiting only those firms from which they can extract the highest bribes and cover the cost of the visit. The equilibrium set R^* of inspected firms, delimited by the continuous vertical lines, is such that both the net benefits of bribing for the firm and the net benefits of visiting for the inspector are positive: a reverse U-shaped relationship exists between demand elasticity and probability of inspection and bribery. The higher is the license fee the lower is the average demand elasticity among inspected firms.

3.2 Inspector's Payoff and Equilibrium With Feedback Incentives

Consider now the introduction of feedback incentives. The wage of the inspector now features a fixed and a variable component, where the latter depends positively on firms' evaluation E. We let higher bribes map into lower inspectors' evaluation. Specifically, we assume that the evaluation E submitted by the firm is decreasing in the fraction of foregone profits or relative profit loss due to bribing, which turns out to be equal to[3]

$$E = (1-b)^r - 1 \tag{8}$$

Notice that $\partial E/\partial b < 0$: the higher the bribe rate b the lower the evaluation E. At the same time, the possibility of larger pass-through makes the negative impact of bribes on profits relatively lower for firms facing a more inelastic demand. The negative relationship between bribes and evaluation is weaker for these firms, i.e. $\partial^2 E/\partial b \partial r < 0$.

In Section 5, we present evidence that supports these assumptions on the shape of the evaluation function. In Appendix A.2.2, we also investigate other possible functional forms and show that the resulting model predictions contrast with the empirical evidence we present in Section 6.

[3]When paying bribes, firm profits are equal to $\tilde{\pi} = \left[\frac{c}{r-1}\right]^{1-r}\left[\frac{r}{1-b}\right]^{-r}$. The fraction of foregone profits when bribes are positive is thus equal to $\left[\frac{c}{r-1}\right]^{1-r}\left[\frac{r}{1-b}\right]^{-r} - \left[\frac{c}{r-1}\right]^{1-r} r^{-r}$ divided by $\left[\frac{c}{r-1}\right]^{1-r} r^{-r}$.

With feedback incentives, the inspector's overall payoff is given by

$$u = w + \int_R B(b,r)dr + s\int_R E(b,r)dr - \delta|R| \tag{9}$$

where $s > 0$ is the piece rate parameter, so that the wage increase proportionally with the evaluation submitted by all inspected firms. Since bribes decrease firms' evaluation, the inspector faces now a trade-off between the two. The new equilibrium is defined by a new bribe rate $\hat{b}$ and set of inspected firms $\hat{R}$. Notice that, under feedback incentives, the bribe is still a fixed proportion b of firm revenues. Indeed, we show in Appendix A.2.3 that the inspector is always better off not revealing the presence of feedback incentives to the firm. It follows that the additional component of inspector's payoff that depends on firm's evaluation is not part of the negotiation and does not add to the surplus that is split between parties. In this case, the inspector bares the full trade-off between bribes and evaluation, but achieves a higher payoff at equilibrium than the one she would receive if the scheme was revealed and the bonus was added to the surplus.

Consider first the case in which the bribe rate is fixed and equal to the equilibrium one in the case of no incentives b^*. Figure 2 shows a graphical representation of the equilibrium with feedback incentives in this case. The vertical continuous lines delimit the new equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives. Bribe capture decreases the evaluation submitted by inspected firms. This decreases the payoff of the inspector, which now includes the evaluation-based bonus component: the green line shifts downwards. It follows that the inspector finds optimal to inspect a smaller set of firms facing a more inelastic demand. The targeting of firms facing a more inelastic demand is even more pronounced when inspectors choose the bribe rate b optimally, as shown in Figure 3. On the one hand, the decrease in bribe rate makes all firms more willing to substitute bribes for taxes, shifting the blue line upwards and pushing into bribing firms facing an even more inelastic demand. At the same time, the decrease in the bribe rate increases the evaluation submitted by inspected firms, and decreases the bribe amount. The new equilibrium bribe rate $\hat{b}$ is such that the equilibrium set of inspected firms $\hat{R}$ is even more shifted towards firms facing a more inelastic demand.

Allowing b to vary with r does not change these results. Figures A.4 and A.5 in Appendix A.2 show a graphical representation of the equilibrium without and with feedback incentives. Inspectors are allowed to charge optimally different bribe rates to different firms. Feedback incentives still prompt inspectors to visit firms facing a more inelastic demand. Figure A.6 explains this result showing that, when feedback incentives are implemented, the equilibrium bribe rate and thus the bribe amount falls differentially more for inspectors dealing with firms facing a more elastic demand.

3.3 Predictions

This theoretical framework has a number of testable implications. In particular:

1. Without monetary incentives, the probability of inspection first increases and then decreases with the elasticity of demand faced by the firm;
2. Feedback incentives prompt inspectors to target firms facing a more inelastic demand;
3. Feedback incentives decrease the bribe rate and the price that inspected firms charge to consumers.

Under feedback incentives, inspectors face a trade-off between bribes and evaluations. They solve it by targeting disproportionally more firms facing a more inelastic demand. This is because the larger pass-through makes paying bribes relatively less burdensome for these firms, mapping into relatively higher inspector's evaluation. From this follows that a tilted feedback incentive scheme that puts more weight on the evaluation submitted by small – high demand elasticity and small pass-through – firms should reduce the incentives for inspectors to target firms facing a less elastic demand. Such tilted scheme limits the scope for targeting and selection of inspected firms while still reducing the bribe rate, although the equilibrium value of the latter is higher than the one obtained under the unweighted scheme. We evaluate the effectiveness of both the unweighted and the weighted piece rate feedback incentive schemes in our field experiment.

Before concluding, note that our model delivers no prediction on the impact of feedback incentives on the overall frequency of inspections. Unless we make specific assumptions on the shape of the demand elasticity distribution across firms, inspection rates can increase or decrease depending on the relative density of firms at different values of demand elasticity. If firms are uniformly distributed over r, feedback incentives decrease inspection rates. This is not necessarily the case if, for example, firm density is decreasing in r.

4 Data

We constructed a sample that is representative of the firm population of interest within the catchment area of each local STS office. As that is the level of implementation of our intervention, we opted for using an initial list of 10,000 businesses provided by STS. This list was the most comprehensive in the hands of the tax authority and provided us with the ability to identify the typical ever listed firm in the catchment area of each local tax office. In particular, the list helped us identify the most crowded business location areas. Given our focus on individual entrepreneurs, the initial list over-represents firms in the categories of license holders and single

tax payers, counting 1,100 contract holders, 4,100 single tax payers, and 4,800 license holders.

Starting from this list, we stratified our target sample of firms according to their tax regime category, turnover size, sector of activity, and local tax office. This was all the information we were given on firms in the list provided by STS. The purpose of drawing from that list is precisely that of adopting the most neutral sample design in terms of the characteristics of the firms in our study, and to produce a representative sample of firms at the tax regime/geographical/sector/size level. Ultimately, our approach allowed us to build a working sampling framework from which we could then fill the various strata by visiting the local markets. We drew one fourth of the businesses in each stratum, getting to a target baseline sample of 2,510 observations.

We carried out the baseline survey in March and April 2016. Whenever the enumerators could not locate the selected firm, we instructed them to replace it with another one belonging to the same stratum. In the end, 73% of surveyed firms were not in the original target sample drawn from the initial list. We excluded those businesses located in the catchment area of the headquarter STS office in Bishkek, and others belonging to 8 remote and very small STS offices.

The baseline sample counts 2,339 businesses distributed across 50 local tax office catchment areas. The relative majority of businesses are in sales or retails (32.53%), followed by food, catering, restaurants (5.94%), transportation (5.61%), and hairdressing (3.99%). Our baseline questionnaire is modeled after the World Bank World Enterprise Survey. We add to the standard questionnaire a number of questions on the relationship between the firm and the tax authority, and their experience with tax inspections. In particular, we ask the respondent whether the business has been inspected in the last year, and in case of an affirmative answer, we ask: *On a scale from 0 to 10 where 0 is a poor job and 10 is a good job, how would you rate the job of the tax inspectors during the last inspection?* We use the answer to this question in our feedback incentive scheme.

We used the information in the baseline survey to test for balancedness of average firm characteristics across the different experimental groups. To begin, Panel A of Table A.1 in Appendix A.1 shows the summary statistics for the variables of interest in the baseline sample. Inspection rates are high: 74% of businesses in the baseline sample report to have been inspected at least once over the last year. The average of inspector's evaluation is 6.5 out of 10. Eliciting firms' engagement in informal relationships with tax inspectors can be challenging. We do so in several ways. We first ask whether a gift, informal payment, or entertainment is typically requested during inspections. 9% of businesses in the sample report that this is the case, and 7% report that firms typically agree to provide them. Later in the survey, we also ask about the typical value or amount of gifts/informal payment requested by tax officials to firms belonging to different revenue categories: 44% of surveyed firms report a positive value.

Finally, 23% of firms report to personally know an entrepreneur that was subject to harassment during a tax inspection.[4]

The bottom part of Panel A shows the summary statistics for business variables. The average number of workers (including proprietors) is 3.2, while monthly revenues are on average about 800USD and monthly profits about 380USD. We use the information on sales and the price of the most sold item to derive quantity, and combine it with information on total cost to derive average production cost (labor and material cost), average administrative cost (including operating expenses), and average total cost. Total cost account for 50% of revenues for the average firm in our sample.

Our intervention took place in October and November 2016, and we administered a follow-up survey between December 2016 and January 2017. The post-intervention sample counts 2,966 businesses. The sampling design we adopted was not built with the objective of constructing a panel of firms, but rather a repeated cross-section of firms within the local STS office catchment areas. This is because, following our theoretical model, we expected that the composition of inspected firms would change differentially in treatment areas. Providing evidence of this selection mechanism is one of the focus of our study, so we also opted for oversampling inspected firms in the post-intervention sample.

Panel B of Table A.1 in Appendix A.1 shows the summary statistics for the variables of interest in the post-intervention sample. 56% of businesses report to have been inspected during the intervention period. To gather direct information on bribes, we asked firms whether the amount of gifts or informal payments requested, the frequency of such requests, and costs associated with inspections decreased, stayed the same, or increased during the intervention period. 53% of surveyed firms report that bribing decreased along all these margins.

We elicit information on the elasticity of demand faced by each business in the sample as in Cunha, De Giorgi, and Jayachandran (2018). After asking the price of the most sold item, we ask: *Suppose that the market price of such product or service increased by X%. By how much the quantity sold would drop in percentage?* We repeat this question for X equal to 5, 10, and 20. As such, the elicited demand elasticity is determined jointly by the shape of the overall demand curve and the level of competitiveness in the market where the firm operates (Bergquist 2017). The bottom of Table A.1 shows that the average drop in quantity sold following a 5% price increase is equal to 4.9%, indicating an average elasticity of demand of 1.

In collaboration with STS, we also collected administrative data on tax inspections and revenues in each of the 50 local tax offices. These office-level data have a monthly frequency

[4]Measures of harassment include: threats to shut down the business, threats made to customers, shouting, scolding, making a nuisance in or near enterprise premises, vandalism of premises or merchandise, confiscation of property or merchandise, theft of property or merchandise, threat of fondling or inappropriate touching or sex, pushing or shoving, beating.

starting in January 2015. Table A.2 in Appendix A.1 shows the summary statistics for the period until April 2017. The number of raid inspectors per local tax office stays constant during the period, averaging 7.12. Each office conducts on average about 4,000 raid inspections each month. Monthly revenues from licenses account for 18% of monthly total tax revenues on average and sum up to 1.5 million USD.

5 Model Validation and Descriptives

The model predicts that, in the absence of feedback incentives, the probability of inspection first increases and then decreases with the elasticity of the demand faced by the firm. Figure 4 plots the distribution of demand elasticity among all firms in the control group, and the same distribution among inspected firms only. Consistent with the model, evidence shows that the probability of inspection is disproportionally higher for firms facing a moderately inelastic demand. These firms are indeed overrepresented among inspected ones, while this is not the case for firms facing a very inelastic or very elastic demand.[5]

Next, we explore whether and how business variables correlate with the likelihood of engaging in informal relationships with tax officials. We define a dummy equal to one if the firm reports that requests of gift, informal payment, or entertainment are common during tax inspections, and regress this variable over firm characteristics. Table 1 reports the corresponding coefficient estimates and p-values in parenthesis.[6] The first column shows that larger firms are significantly more likely to report that gifts or informal payment requests are common. The independent variable is a dummy equal to one if the firm counts more than one worker, including proprietors. In column (2), we replace as regressor the log of the number of workers and proprietors. Columns (3) to (5) show that firms reporting gifts or informal payment requests during inspections have significantly higher sales, revenues, and profits than others. These results altogether show that the incidence of inspections and bribes is systematically higher among larger firms.

The only dimension of firm heterogeneity in our model is the elasticity of the demand faced by the firm. As discussed in the previous section, we derive three measures of demand elasticity from the answers to the question of how much demand would drop if price were to increase by 5, 10, and 20%. To validate these measures, we test whether their value increases systematically with the number of competing firms operating in the same narrowly defined sector and locality.

[5]The results from a Kolmogorov-Smirnov test of equality of distributions indicate that we can reject at the 1% significant level the null hypothesis that the distribution of demand elasticity is equal among inspected and non-inspected firms.

[6]Given the low number of clusters, and high heterogeneity in the number of observations per cluster, we obtain Wild-bootstrapped p-values in parenthesis, clustering standard errors at the office level (Mackinnon and Webb 2017).

The estimates reported in Table A.3 in Appendix A.1 show that this is the case.[7]

The demand elasticity measures correlate with business variables as the model predicts. Columns (1) to (3) of Table 2 show that firms facing a more inelastic demand are systematically larger. Column (4) also shows that these firms have higher average cost. In line with the results in Table 1, columns (5) to (7) of Table 2 show that demand elasticity is significantly negatively correlated with the incidence of gift or informal payment requests. Importantly, column (8) shows that differences in average cost do not map systematically into differences in gift or informal payment requests. This further validates the model's focus on demand elasticity rather than cost as the relevant margin of firm heterogeneity.[8]

In our model, license fees are a fixed cost while bribes increase proportionally with revenues. In our survey, we ask firms what is the total value of licenses they have to purchase in order to operate their business. We also ask each respondent about the typical value of gifts or informal payments requested by tax officials to firms in different revenue categories.[9] The left graph of Figure 5 plots the average value of licenses for firms in the food sale industry – the most represented sector in our sample – together with the 95% confidence interval. It does so separately for different revenue categories. Evidence shows that the total value of license fees does not differ significantly across groups of firms reporting different revenues. The right graph of Figure 5 shows instead that the value of gifts or informal payments changes systematically with revenues. The value of gifts appears to be proportional to revenues – as in the model equilibrium – and equal to around 3% in each category.[10] Moreover, the average value of gifts is either significantly lower or not significantly different from the estimated value of licenses depicted in the left graph. This indicates that the value of gifts or informal payment requested does not exceed the value of licenses. Figure A.1 and A.2 in Appendix A.1 show that a similar pattern holds for other sectors as well, such as bakery and clothing sale.

Finally, we assume in our model that the evaluation of inspectors decreases with the value of bribes. Specifically, we assume that evaluations decrease with the fraction of forgone profits due to bribing. Two pieces of evidence validate this assumption. First, Table 3 shows that

[7]To validate the elasticity measures further, we also look at their relationship with the price charged to consumers, conditional on average cost. Columns (1) to (3) of Table A.4 in Appendix A.1 shows that demand elasticity is negatively correlated with prices, although the corresponding coefficient estimates are not significant. In columns (4) to (6), we match the model more closely and use the same measures of elasticity to calculate the log of mark up, and substitute the latter for the elasticity measure in the price regression. Estimates show that mark up is positively correlated with the price charged to consumers, even if again not significantly so.

[8]More precisely, we are interested in ruling out marginal cost as a relevant source of firm heterogeneity that correlates with bribe incidence. To shed light on the relationship between average and marginal cost, we implement a procedure similar to Hall (1988) to calculate marginal cost for the subset of firms in our sample that we observe at multiple points in time. We exploit within-firm variation in total cost and quantity sold over time to back up the marginal cost and find it to be positively correlated with average cost.

[9]We ask these questions in a separate third round of data collection with the same sampling and replacement strategies of the post-intervention survey. We conducted this last survey in October and November 2017.

[10]We derive these values by asking in our survey: *Consider one business that has monthly revenues of [revenue category amount]. What would be the typical value or amount of gifts/informal payment requested by tax officials?*

reporting gift or informal payment requests is systematically negatively correlated with the evaluation of the job of inspectors during the most recent visit. Second, in our survey we asked: *Suppose you were inspected by a tax inspector and were asked for a gift equal to X% of your profits. How much would be your evaluation of the inspector on a scale from 0 to 10, where 0 is a poor job and 10 is a good job?* We let X vary between 0, 5, 10, and 20. Over 80% of firms respond that their evaluation would be 10/10 if no gifts were requested. Only less than 1% would give an evaluation of 0 in this case, with the average being 9.4 – the average actual evaluation score is 6.5. If asked for 5% of their profits, almost 60% of firms would give an evaluation of 0, with the average collapsing to 1.5. If asked for 10% and 20% of their profits, the fraction of firms that would rate the inspector with 0 would increase to 67 and 84% respectively, with the average being less than 1. Importantly, these patterns do not differ systematically across firms according to the elasticity of the demand they face or their revenues. This supports the assumption that it is the relative rather than absolute amount of foregone profits due to bribes that matters for inspectors' evaluation.

Taken altogether, the evidence presented in this section validates the main assumptions of our theoretical framework and its most basic implications. In particular, it highlights the crucial role of demand elasticity in shaping both sides of the relationship between firms and business tax inspectors. We will now turn to explore its implications for inspectors' response to feedback incentives using the variation generated by our field experiment.

6 Intervention

Our theoretical findings led us in the design of two separate treatments. In both of them, inspectors are awarded a bonus payment on top of their base salary. The bonus amount is a piece rate that increases with the anonymous evaluation submitted by inspected firms. Specifically, all inspectors in local office g are awarded the same piece rate bonus whose amount increases with the improvement in average evaluation. The bonus payment P_g is equal to

$$\begin{aligned} P_g &= \max\{\gamma \times E_g \times 100, 0\} \\ \text{with} \quad E_g &= \frac{S_g^1 - S_g^0}{10 - S_g^0} \end{aligned} \tag{10}$$

where S_g^0 is the average evaluation submitted at baseline by inspected firms in office g's catchment area, and S_g^1 is the average evaluation at follow-up. E_g captures the change in average evaluation from baseline to follow-up, and relative to how far the average evaluation at baseline was from the maximum attainable value of 10. We set $\gamma = 1.95$ USD in both treatment arms. This means that the maximum bonus awarded individually is equal to 195 USD. The baseline monthly salary of inspectors is around 100 USD (7,000 Kyrgyz Soms). The median firm in

our baseline sample reports revenues equal to 2,100 USD (30,000 Kyrgyz Soms). At the same time, firms report a value of gifts or informal payments of around 3%, and thus equal to around 60 USD for the median firm. This indicates that the maximum attainable bonus is more than three times the value of bribes paid by the median firm in our baseline sample.

The schemes that we implemented in the two treatment arms differ in the weighting of the average evaluation S_g. In the first treatment arm (PR), the average is unweighted. Our model predicts that inspectors would respond along the extensive margin and target relatively larger firms facing a more inelastic demand. To counteract this effect and limit the scope for targeting, we implemented as second treatment a tilted version of piece rate (PRT) incentives where we attach different weights to the evaluation submitted by firms of different size. In this case, S_g is a weighted average, with weights equal to 1, 2/3, and 1/3 for firms with 1, 2 or 3, and more than 3 workers respectively, including proprietors.

We randomly assigned 20 of the 50 STS local offices to PR incentives, 20 to PRT incentives, and 10 to the control group. Figure A.3 in Appendix A.1 shows a map indicating the location of these 50 STS local offices. We stratified the randomization according to baseline inspection rates per office, and verified ex-post the balancedness of baseline observable firm-level characteristics. We test for balancedness at baseline and for treatment effects during the intervention period by implementing the following regression specification

$$Y_{ig} = \beta_0 + \beta_1 PR_g + \beta_2 PRT_g + \mathbf{X}'_{ig}\theta + v_{ig} \tag{11}$$

where Y_{ig} is the outcome variable of interest for firm i located in office g's catchment area. PR_g and PRT_g are two dummies equal to one if office g is assigned to the regular piece rate or the tilted piece rate feedback incentive scheme respectively. $\mathbf{X}_{ig}$ is a vector of firm-level characteristics that includes dummies for each category of the stratification variables (size, tax regime, STS office group, sector) and a dummy for Bishkek.[11] v_{ig} captures residual unobserved determinants of Y_{ig}.

Table A.5 in Appendix A.1 shows that the characteristics of local tax offices are balanced at baseline across the three experimental groups. We consider the sample of monthly office-level observations in 2015. The table reports the coefficient estimates from a regression of office-level characteristics over the two treatment dummies and month fixed effects. It also shows the p-values from a test of equality between the two estimated coefficients. Almost none of the estimates is significant at the standard significance levels. The only exception is in column (7) showing that the ratio of revenues from license to inspections is marginally significantly lower in offices assigned to the unweighted PR treatment than in the control group. Yet, this is the only instance in which we can reject the hypothesis of balancedness out of the 24 tests

[11] When Y_{ig} is a business variable, we use $\log(Y_{ig})$ as dependent variable. We also include a dummy for $Y_{ig} = 0$ as additional regressor in order to account for bunching and misreporting at zero.

summarized in the table.

Table A.6 shows that baseline firm-level characteristics are also balanced across the three experimental arms. The table reports the coefficient estimates from the regression specification in equation 11 using the entire baseline sample. None of the estimates is significant at the standard significance levels. In particular, evidence shows no systematic differences in the probability of inspection, the evaluation of the job of the inspector, and and reported prevalence of gift or informal payment requests. This is true also within the categories of large and small firms as defined by whether they report more than one worker, including proprietors. Table A.7 shows that the same is true for business variables.[12]

7 Results

7.1 Targeting

Our model delivers predictions on how feedback incentives induce targeting along the specific margin of demand elasticity. Under PR incentives, inspectors should target disproportionally more firms facing a more inelastic demand, while this should be less or not the case under PRT incentives. These theoretical predictions are matched by the experimental evidence. Similarly to Figure 4, Figure 6 shows the distribution of demand elasticity among all firms and inspected firms only, this time separately for each experimental group. The blue shaded line is the same across all figures as it plots the distribution among all firms in the sample. Compared to the control group, the distribution of demand elasticity is even more shifted leftwards under the unweighted PR scheme. Evidence shows a decrease in the density in the middle of the distribution that is paired with an increase in the frequency of firms facing a very inelastic demand. This pattern is reversed under PRT, where the distribution of inspected firms appears to be more aligned with the overall demand elasticity distribution.

Figure 7 provides additional evidence of targeting. It plots the smoothed average probability of inspection over the elasticity of demand faced by the firm, together with its 95% confidence interval, and separately for each experimental group. Both variables are residuals obtained after projecting them on stratification variables and other controls as specified in the discussion of equation 11. Consistent with Figure 4, the left graph shows that firms facing a moderately low elasticity of demand are significantly more likely to be inspected in the control group. The middle graphs shows evidence of targeting under PR incentives: low elasticity firms are disproportionally more likely to be inspected, while the opposite is true for firms facing a highly elastic demand. The right graph shows that the tilted scheme discourages targeting, as

[12]Table A.8 in Appendix A.1 shows evidence of balancedness of business variables among inspected firms as well.

the conditional probabilities of inspection are closer to those observed in the control group.

These patterns are confirmed when analyzed in a regression framework. Table 4 reports coefficient estimates from the regression specification in equation 11, having as outcome the elasticity of demand faced by the firm. We restrict the sample to those firms that report to have been inspected during the intervention period. Evidence shows that the average elasticity of demand faced by inspected firms is significantly lower under PR incentives compared to the control group, and significantly lower than under PRT incentives when using the first measure of demand elasticity. Importantly, we find no evidence of targeting along the margin of average cost, validating once again the key role of demand elasticity and pass-through emphasized in our theoretical framework.

7.2 Inspections, Bribes and Evaluations

Our model delivers no prediction on the effect of feedback incentives on the overall probability of inspection. A change in the composition of inspected firms along the specific margin of demand elasticity may result in higher or lower overall inspection rates depending on the shape of the distribution of demand elasticity across firms. In contrast, the model unambiguously predicts that feedback incentives increase the evaluation submitted by inspected firms. Table 5 reports the coefficient estimates from the regression specification in equation 11 implemented on the post-intervention sample. The dependent variable in column (1) is a dummy equal to one if firm reports to have been inspected during the intervention period. Evidence shows that feedback incentives lead to fewer inspections. The probability of inspection is lower in both treatment arms, significantly so at the 10% level under PRT incentives.

Our model predicts that feedback incentives decrease the bribe amount. In column (2), we replace as dependent variable a dummy equal to one if the firm reports a reduction in the amount of gifts or informal payments requested, the frequency of such requests, and costs associated with inspections during the intervention period. Estimates show that, where feedback incentives are implemented, firms are more likely to report a reduction in bribing along all these margins. Point estimates are similar across the two treatment arms, but significant at the 10% level only under PR incentives. This is consistent with the model predicting a larger decrease in the bribe amount under PR incentives compared to PRT ones.

In theory, the evaluation submitted by inspected firms should be higher when feedback incentives are in place. We test this hypothesis in column (3), where we restrict the sample to inspected firms. Evidence shows that inspected firms in treatment arms submit higher evaluations than in the control group, significantly so at the 10% level under PR incentives.[13] The

[13] Given the incentive scheme in equation 10, we adjust the evaluation score and compute the dependent variable in column (2) as the difference between the evaluation submitted by the firm and the average evaluation at baseline,

point estimate of the PRT dummy coefficient is not significant. Together with the evidence discussed above, these results match the model predictions. They show that the significant increase in evaluations under PR incentives materializes through a change in the composition of inspected firms and inspectors' targeting response to incentives.

Columns (4) to (9) further validate this interpretation of results. They report coefficient estimates obtained after implementing the same regression specifications separately for the sub-samples of large and small firms. Results show that the effects reported in columns (1) to (3) are driven by large firms, which are significantly less likely to be inspected under PRT incentives, and are significantly more likely to report lower bribes and submit significantly higher evaluations under PR ones.

7.3 Prices and Business Cost

The model predicts that, by reducing the bribe amount, feedback incentives reduce the price inspected firms charge to consumers. Table 6 shows the estimated treatment effects on business variables for all inspected firms, and then separately for large and small firms. Under feedback incentives, inspected firms charge lower prices, significantly so at the 5% level under PR incentives. The effect is lower in magnitude and non-significant under PRT incentives, which is again consistent with our model predicting a smaller decrease in the bribe amount in this case. Once again, the effect is driven by large firms, which is paired with a significant negative treatment effect on average total cost and average administrative cost.

The evidence of targeting presented above suggests that selection may bias these estimates, as the average firm inspected under PR incentives is systematically different. However, Table 4 shows that these firms face a more inelastic demand, and should therefore charge higher prices with respect to the control group. In other words, the targeting of large – low demand elasticity and large pass-through – firms should induce a positive change in prices under PR incentives as opposed to the significant negative effect that we find, which is therefore biased towards zero.

We interpret the results in Table 6 as evidence that feedback incentives change inspectors' activity also on the intensive margin, reducing the bribe rate and therefore the price charged by inspected firms to consumers. Small firms in the PRT treatment arm also have lower average cost and charge lower prices, but the corresponding coefficient estimates are not statistically significant at the standard levels.

divided by the difference between 10 and the latter.

7.4 Tax Revenues

Finally, Table 7 shows evidence of the effect of our intervention on inspections and tax revenues at the level of local offices. We implement a difference-in-differences regression specification, and regress each outcome over the interaction of the two treatment dummies with a dummy that takes value one for all months following the beginning of the intervention – from October 2016 onwards – together with the full set of office and month-year fixed effects. Given that licenses are valid for a period that may exceed the two months of intervention, we run this regression using all available monthly data, from January 2015 until April 2017 – up to five months after the intervention. The third column of Table 7 shows that our intervention increases revenues from licenses, significantly so at the 10% level under PRT incentives. This is consistent with the evidence in Table 5 showing a significant decrease in inspections reported by firms. As captured in our conceptual framework, firms substitute bribes for taxes: a reduction in inspectors' activity along the extensive margin is associated with an increase in tax revenues from licenses.

8 Conclusion

Bribe prevalence is much higher among firms in the developing world compared to their counterparts in developed countries. There is still limited evidence on policies that can reduce bribe payments in environments with low state capacity and low bureaucratic efficiency.

We designed and tested a policy instrument aimed to decrease bribe payments to business tax inspectors among micro and small enterprises. By rewarding inspectors according to the average evaluation submitted by inspected firms, our intervention strengthens the bargaining position of firms in their informal relationship with tax officials. We use a simple model to show that firm heterogeneity and market forces can shape the firms' willingness to engage in such relationships, and inspectors take these margins into account in their activity. Our findings are consistent with the main model predictions: under feedback incentives, inspectors target disproportionally more firms facing a more inelastic demand that can therefore more easily pass through bribes to consumers. A tilted scheme that attaches more weight to the evaluation of smaller firms limits the scope for targeting and increases tax revenues.

Our study delivers two main findings. First, market structure and firm heterogeneity in the extent of pass-through matter in shaping the bribery incentives of business tax inspectors, and need to be taken into account when designing policies to curb corruption. Second, firms use prices to pass through bribes to consumers, and corruption that affects firms decreases consumer welfare. In our future research, we plan to investigate these issues in a dynamic framework, looking at business, consumer, and tax revenue outcomes over a longer period of time.

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Tables and Figures

Table 1: Bribes and Firm Size

	Gift/Informal Payment is Common				
	(1)	(2)	(3)	(4)	(5)
Big	0.056				
	(0.000)				
Employment		0.037			
		(0.001)			
Sales			0.044		
			(0.001)		
Revenues				0.028	
				(0.023)	
Profits					0.021
					(0.001)
Mean	0.097	0.097	0.098	0.103	0.100
Observations	5193	5193	3795	3863	3904
R^2	0.048	0.047	0.074	0.068	0.058

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. The dependent variable is a dummy equal to one if the firm reports that requests of gift, informal payment, or entertainment are common during tax inspections.

Table 2: Demand Elasticity, Size and Bribes

	Big				Gift/Informal Payment is Common			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Elasticity_5	-0.032				-0.030			
	(0.059)				(0.006)			
Elasticity_{10}		-0.050				-0.022		
		(0.003)				(0.050)		
Elasticity_{20}			-0.041				-0.019	
			(0.022)				(0.084)	
$\ln(\text{Avg Cost})$				0.082				0.004
				(0.001)				(0.638)
Mean	0.481	0.477	0.476	0.460	0.097	0.101	0.103	0.101
Observations	2258	2294	2303	3402	2262	2298	2307	3412
R^2	0.063	0.068	0.067	0.099	0.086	0.088	0.097	0.062

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. In column (1) to (4), the dependent variable is a dummy equal to one if the firm reports having more than one worker, including proprietors. In column (5) to (8), the dependent variable is a dummy equal to one if the firm reports that requests of gift, informal payment, or entertainment are common during tax inspections.

Table 3: Bribes and Evaluation

	Evaluation (0-10)	Evaluation (adj.)	Evaluation =10
	(1)	(2)	(3)
Gift is Common	-1.424	-0.363	-0.094
	(0.000)	(0.004)	(0.003)
Mean	6.460	-0.053	0.136
Observations	2349	2309	3400
R^2	0.071	0.057	0.022

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. The dependent variable in column (1) is the unadjusted evaluation score submitted by the firm, taking values from 0 to 10. The dependent variable in column (2) is the adjusted evaluation score, equal to the unadjusted score minus its baseline average within the corresponding tax office catchment area. The dependent variable in column (3) is a dummy equal to one if the evaluation score is equal to 10.

Table 4: Intervention - Characteristics of Inspected Firms

	Elasticity_5	Elasticity_{10}	Elasticity_{20}	Average Cost
	(1)	(2)	(3)	(4)
Piece Rate	-0.235	-0.326	-0.333	-0.160
	(0.074)	(0.028)	(0.006)	(0.162)
Piece Rate Tilted	0.051	-0.095	-0.134	0.020
	(0.649)	(0.522)	(0.435)	(0.906)
Difference PR-PRT	0.022	0.129	0.160	0.291
Control Mean	0.859	0.927	0.887	0.659
Observations	1365	1388	1385	1375
R^2	0.067	0.074	0.095	0.048

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. The dependent variables in columns (1) to (3) are defined according to the answer to the question: *Suppose that the market price of such product or service increased by X%. By how much the quantity sold would drop in percentage?* With X equal to 5, 10, and 20 respectively. The dependent variable in column (4) is derived by dividing total revenues by the elicited price of the most sold item in order to derive quantity sold. We then divide total cost by this quantity to obtain a measure of average cost.

Table 5: Intervention - Inspection Variables

				Large Firms			*Small Firms*		
	Inspected	Bribes Decreased	Evaluation (adjusted)	Inspected	Bribes Decreased	Evaluation (adjusted)	Inspected	Bribes Decreased	Evaluation (adjusted)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Piece Rate	-0.155	0.182	0.447	-0.082	0.176	0.496	-0.211	0.162	0.354
	(0.248)	(0.096)	(0.094)	(0.527)	(0.069)	(0.087)	(0.155)	(0.219)	(0.138)
Piece Rate Tilted	-0.184	0.189	0.236	-0.180	0.177	0.272	-0.171	0.190	0.143
	(0.099)	(0.146)	(0.267)	(0.070)	(0.121)	(0.273)	(0.239)	(0.217)	(0.451)
Difference PR-PRT	(0.763)	(0.949)	(0.400)	(0.301)	(0.993)	(0.409)	(0.738)	(0.833)	(0.402)
Control Mean	0.683	0.426	-0.346	0.709	0.408	-0.380	0.649	0.449	-0.299
Observations	2896	2896	1547	1508	1508	850	1384	1384	695
R^2	0.090	0.099	0.121	0.136	0.135	0.136	0.075	0.090	0.124

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, restricted to inspected firms in columns but (3), (6), and (9). Estimates are conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. In columns (4) to (9), the sample is split between large and small firms, where large firms are defined as those reporting more than one worker, including proprietors, and small firms are the others. The dependent variable in columns (1), (4), and (7) is a dummy equal to one if the firm reports to have been inspected during the intervention period. The dependent variable in columns (2), (5), and (8) is a dummy equal to one if the firm reports that the amount of gifts/informal payment requested, the frequency of such requests, and costs associated with inspections have decreased during the intervention period. The dependent variable in columns (3), (6), and (9) is the adjusted evaluation score, equal to the unadjusted score minus its baseline average within the corresponding tax office catchment area.

Table 6: Intervention - Business Variables

					Large Firms				*Small Firms*			
	Price	Average Cost	Average Adm. Cost	Profits	Price	Average Cost	Average Adm. Cost	Profits	Price	Average Cost	Average Adm. Cost	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Piece Rate	-0.280	-0.266	-0.190	0.134	-0.302	-0.236	-0.200	0.032	-0.166	-0.186	-0.146	0.338
	(0.024)	(0.050)	(0.063)	(0.416)	(0.044)	(0.092)	(0.043)	(0.803)	(0.220)	(0.229)	(0.332)	(0.222)
Piece Rate Tilted	-0.174	-0.027	-0.041	-0.157	-0.115	0.140	0.063	-0.168	-0.225	-0.164	-0.213	0.009
	(0.219)	(0.838)	(0.760)	(0.432)	(0.562)	(0.463)	(0.749)	(0.389)	(0.141)	(0.319)	(0.225)	(0.953)
Difference PR-PRT	(0.393)	(0.094)	(0.276)	(0.137)	(0.366)	(0.131)	(0.206)	(0.173)	(0.693)	(0.873)	(0.553)	(0.253)
Control Mean	1.508	1.089	0.673	5.125	1.610	1.161	0.654	5.543	1.366	0.981	0.703	4.514
Observations	1621	1377	1405	1402	891	763	784	777	728	612	619	623
R^2	0.039	0.047	0.048	0.660	0.056	0.071	0.082	0.651	0.056	0.054	0.064	0.711

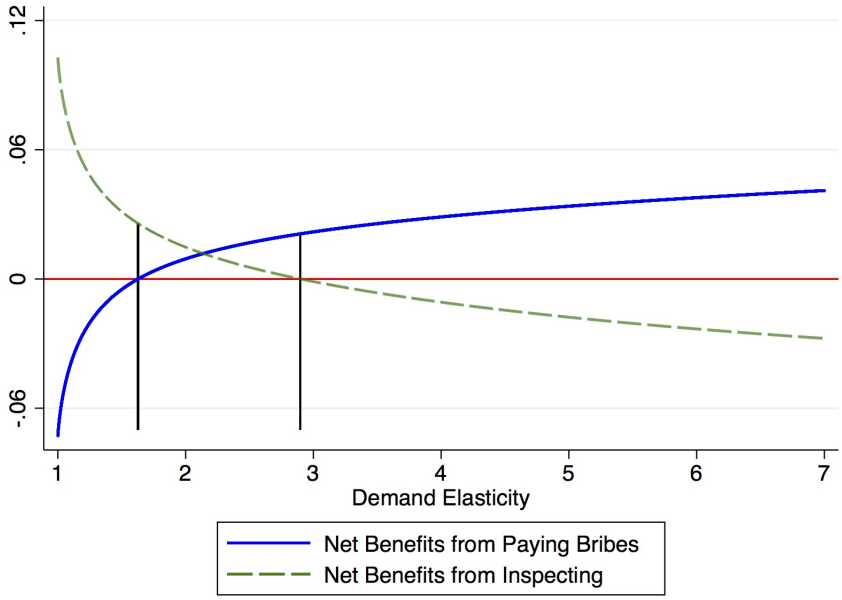
Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, restricted to inspected firms, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. In columns (4) to (9), the sample is split between large and small firms, where large firms are defined as those reporting more than one worker, including proprietors, and small firms are the others. Business variables are in log, and the regressions include a dummy that is one when the value of the outcome is equal to zero. The dependent variables in columns (2), (3), (5), (6), (8), and (9) are derived by dividing total revenues by the elicited price of the most sold item in order to derive quantity sold. We then divide total and administrative cost by this quantity to obtain a measure of average cost and average administrative cost.

Table 7: Intervention - Office Variables

	Number of Inspections (1)	Registered Licenses (2)	Revenues from Licenses (3)	License Rev. per Inspection (4)
Post × Piece Rate	-0.144	-0.076	0.041	0.189
	(0.229)	(0.259)	(0.418)	(0.174)
Post × Piece Rate Tilted	-0.158	-0.060	0.048	0.206
	(0.197)	(0.451)	(0.089)	(0.141)
Difference PR-PRT	(0.869)	(0.811)	(0.877)	(0.849)
Baseline Control Mean	8.090	6.854	7.151	-0.939
Observations	1398	1400	1400	1398
R^2	0.939	0.882	0.982	0.947

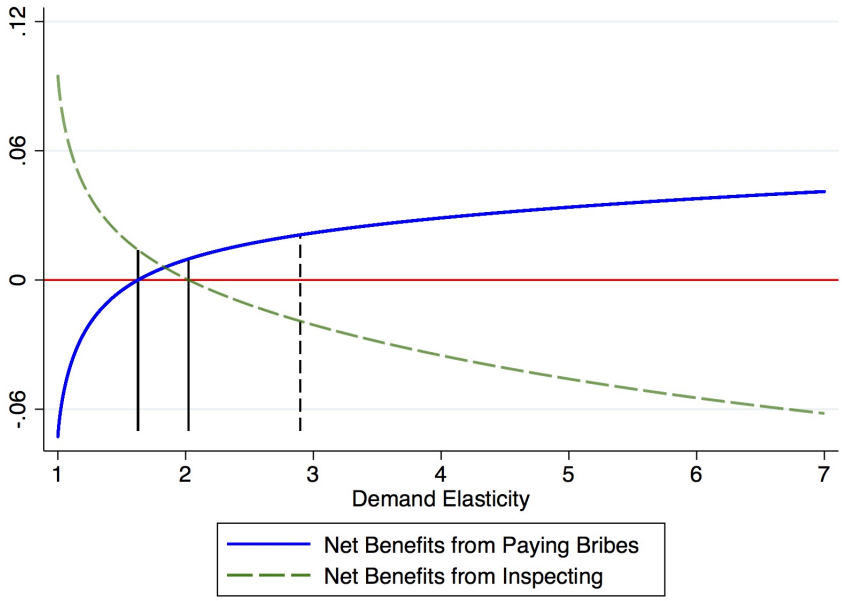
Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the sample of monthly observations for all 2015 and 2016. All dependent variables are in logs. Office and month fixed effects are included in all specification. Post (intervention) period is from October 2016 to April 2017.

Figure 1: Equilibrium with No Incentives



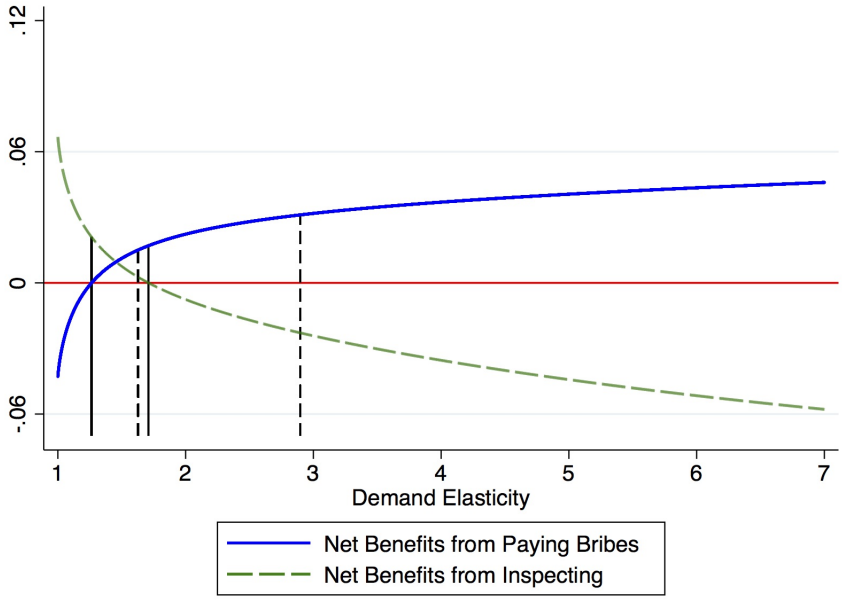
Notes. The figure illustrates the model equilibrium in the baseline case of no feedback incentives. The vertical continuous lines delimit equilibrium set of inspected firms.

Figure 2: Equilibrium with Feedback Incentives and Fixed Bribe Rate



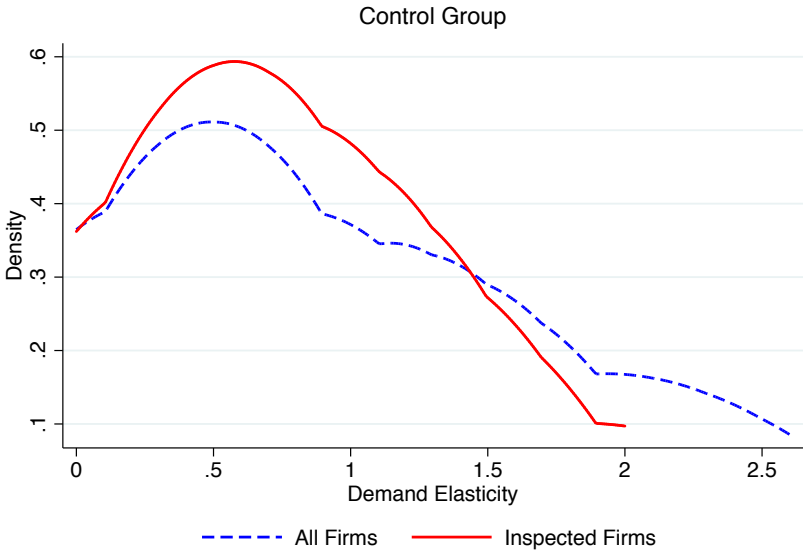
Notes. The figure illustrates the model equilibrium in the case with feedback incentives but constant bribe rate. The vertical continuous lines delimit the equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives.

Figure 3: Equilibrium with Feedback Incentives



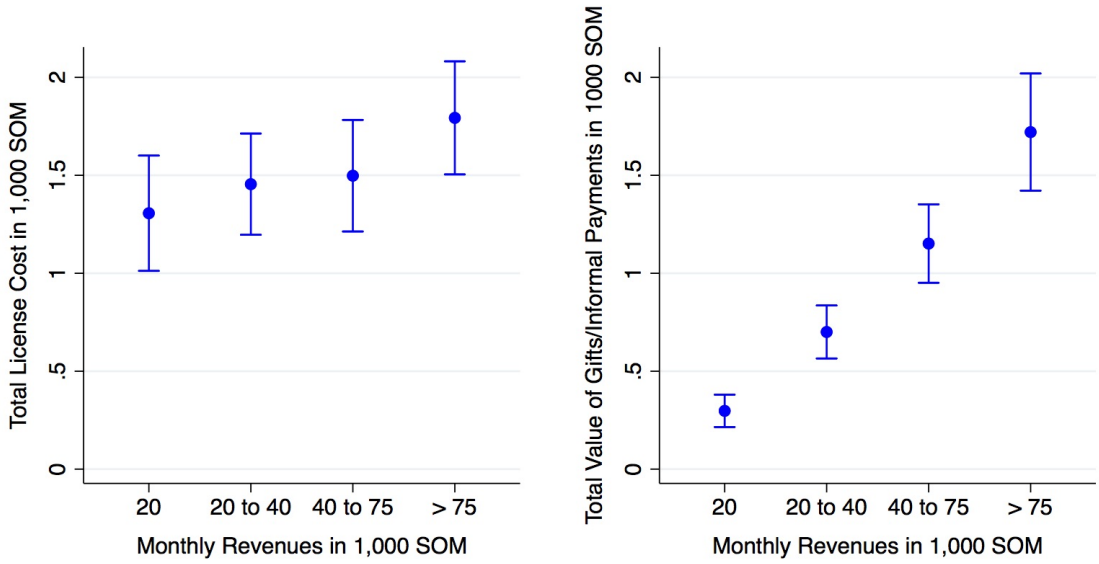
Notes. The figure illustrates the model equilibrium in the case with feedback incentives and optimally chosen bribe rate. The vertical continuous lines delimit the equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives.

Figure 4: Inspections and Demand Elasticity



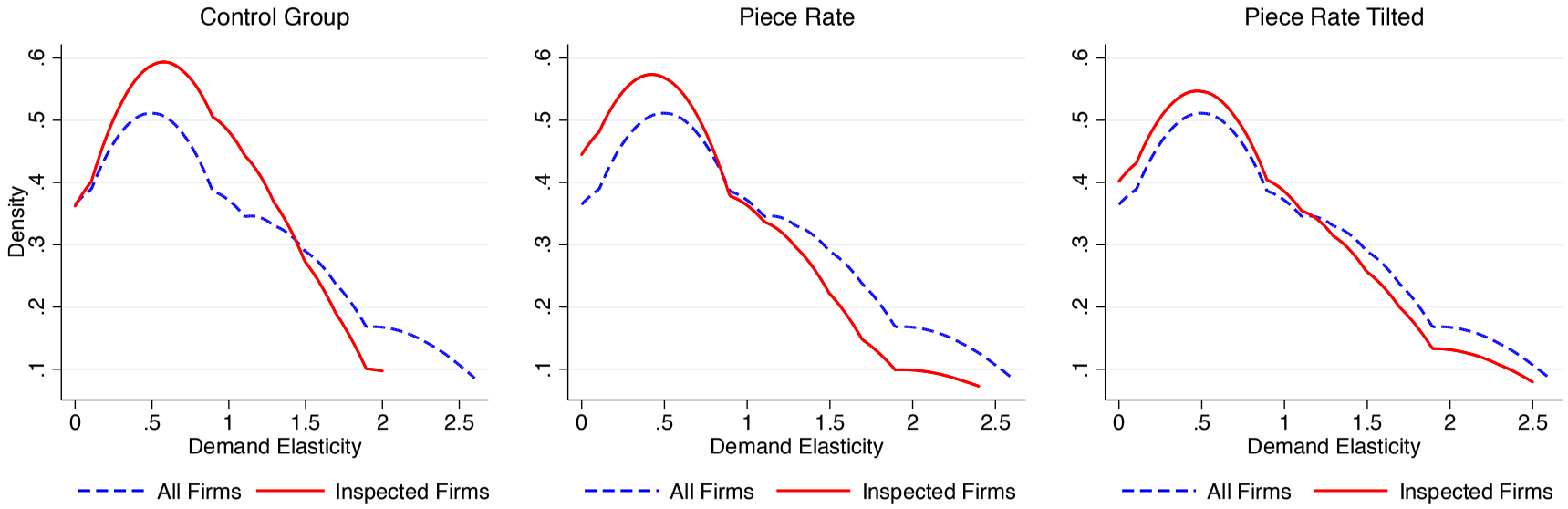
Notes. The figure plots the distribution of the elasticity of demand separately among all firms and among inspected firms only. Demand elasticity is derived from the answer to the question: *Suppose that the market price of such product or service increased by 5%. By how much the quantity sold would drop in percentage?* Firms facing a moderately inelastic demand are overrepresented among inspected firms.

Figure 5: License Fees and Gifts/Informal Payments - Food Sale



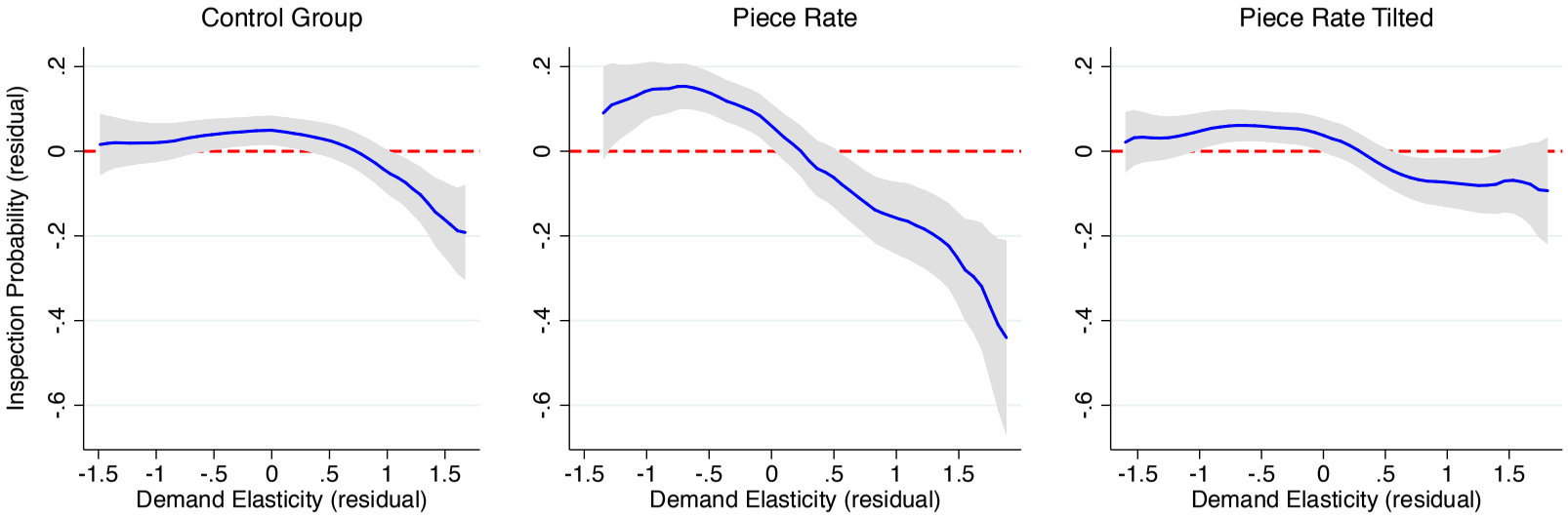
Notes. The figure plots the average total cost of licenses and the average value of gifts/informal payments in the food sale sector as reported in our survey and separately across four revenue categories, together with 95% confidence intervals.

Figure 6: Inspections and Demand Elasticity Across Treatments



Notes. The figure plots the distribution of the elasticity of demand separately among all firms and among inspected firms only. Demand elasticity is derived from the answer to the question: *Suppose that the market price of such product or service increased by 5%. By how much the quantity sold would drop in percentage?* Firms facing a more inelastic demand are overrepresented among inspected firms, separately for each experimental group. Compared to the control group, the distribution of demand elasticity is shifted leftwards under the unweighted PR scheme, while the opposite is true under PRT.

Figure 7: Inspections and Demand Elasticity Across Treatments - Residuals



Notes. The figure plots the average residual probability of inspection over the residual demand elasticity in the three experimental arms. Demand elasticity is derived from the answer to the question: *Suppose that the market price of such product or service increased by 5%. By how much the quantity sold would drop in percentage?* Residuals are obtained after regressing both variables over the full set of stratification variables and controls. Firms facing a more inelastic demand are more likely to be overrepresented among inspected firms in PR, while this is not the case for firms in PRT.

A Appendix

A.1 Additional Tables and Figures

Table A.1: Summary Statistics - Firms

Variable	Mean	Std. Dev.	Min.	Max.	N
		Panel A: Baseline Sample			
Inspected (last year)	0.74	0.439	0	1	2339
Evaluation (0-10)	6.536	2.53	0	10	762
Gift/Informal Payment is Common	0.093	0.291	0	1	2339
Gift/Informal Payment is Paid	0.073	0.26	0	1	2339
Harassment Awareness	0.232	0.422	0	1	2339
Price	1.812	5.476	0.001	50	2031
Employment	3.264	7.958	1	300	2301
Sales	57.461	68.930	0.667	583.333	1393
Revenues	57.236	82.577	0	622.575	1563
Profits	27.264	41.316	0	300	1552
Total Costs	28.451	47.721	0	441.667	1736
Quantity (derived)	581.831	1197.066	0.028	14705.883	1354
Average Cost (derived)	0.994	3.51	0	38.5	1188
Average Administrative Cost (derived)	0.452	1.445	0	14.167	1214
		Panel B: Post-intervention sample			
Inspected (last 2 months)	0.563	0.496	0	1	2966
Evaluation (0-10)	6.429	2.356	0	10	1612
Evaluation (adjusted)	-0.077	0.857	-5.622	1	1571
Bribes Decreased	0.533	0.499	0	1	2966
Price	1.142	4.482	0.001	50	2841
Employment	2.397	3.666	1	70	2961
Sales	67.857	88.275	0	600	2468
Revenues	64.946	80.894	0	600	2363
Profits	26.182	31.815	0	300	2411
Total Costs	35.675	57.254	0	470	2591
Quantity (derived)	978.555	2000.552	0	16333.333	2422
Average Cost (derived)	0.702	3.018	0	40	2287
Average Administrative Cost (derived)	0.21	0.837	0	13	2323
% Drop in Demand if Price Increases by 5%	4.914	6.832	0	95	2325
% Drop in Demand if Price Increases by 10%	9.141	9.136	0	110	2361
% Drop in Demand if Price Increases by 20%	16.628	14.545	0	120	2369

Notes. The table reports the summary statistics of the variable used in the empirical analysis, separately for the baseline and post-intervention sample. Value of business variables is monthly and in 1,000 Kyrgyz SOM ($\sim$14 USD).

Table A.2: Summary Statistics - Local Tax Offices

Variable	Mean	Std. Dev.	Min.	Max.	N
Number of Inspectors	7.12	5.975	3	29	50
Inspections to Individual Entrepreneurs	4497.678	4087.315	695	32195	1398
license Registrations	1278.214	1603.539	7	7043	1400
Revenues from licenses	2165.378	3624.688	59.8	16503.199	1400
Revenues from licenses per Inspector	235.482	233.942	11.96	1581.912	1400
Total Revenues	12074.634	24389.375	42	184097.203	1360
Total Revenues per Inspector	1334.519	2552.644	7	28701.25	1360

Notes. The table reports the summary statistics of the variable at the local office level used in the empirical analysis. Data are monthly and for the period from January 2015 to April 2017. Values of revenue variables are in 1,000 Kyrgyz SOM ($\sim$14 USD)

Table A.3: Demand Elasticity and Number of Competitors

	Elasticity_5	Elasticity_{10}	Elasticity_{20}
	(1)	(2)	(3)
No. of Competitors	0.005	0.004	0.004
	(0.095)	(0.097)	(0.070)
Mean	2.925	2.867	2.768
Observations	1995	2021	2013
R^2	0.002	0.003	0.004

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, restricted to observations outside Bishkek. The dependent variables in columns (1) to (3) are defined according to the answer to the question: *Suppose that the market price of such product or service increased by X%. By how much the quantity sold would drop in percentage?* With X equal to 5, 10, and 20 respectively. The dependent variable in column (4) is derived by dividing total revenues by the elicited price of the most sold item in order to derive quantity sold. We then divide total cost by this quantity to obtain a measure of average cost. The number of competitors is derived by counting the number of surveyed firms in the same narrowly defined sector. We define such sectors based on the reported main activity. We identify 67 different sectors of which the most represented in our sample are: food sale (13%), clothing (13%), passenger transportation (6%), grocery (5%), sale of home appliances (4%), farming (3%), shoes sale (3%), hardressing (3%), car repair (3%), electronics (2%), caf'e (2%), beauty salon (2%), pharmacy and sale of related products (2%).

Table A.4: Price, Average Cost and Demand Elasticity

	ln(Price)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Avg Cost)	0.988	0.977	0.984	0.988	0.976	0.983
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Elasticity_5	-0.117					
	(0.167)					
Elasticity_{10}		-0.035				
		(0.597)				
Elasticity_{20}			-0.038			
			(0.673)			
Mark-up_5				0.192		
				(0.206)		
Mark-up_{10}					0.025	
					(0.827)	
Mark-up_{20}						0.030
						(0.840)
Mean	1.455	1.448	1.453	1.455	1.448	1.453
Observations	1888	1922	1921	1888	1922	1921
R^2	0.783	0.774	0.777	0.783	0.774	0.777

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek.

Table A.5: Balancedness - Office Variables

	Number of Inspectors (1)	Total Revenues (2)	Revenues per Inspector (3)	Number of Inspections (4)	Registered Licenses (5)	Revenues from Licenses (6)	License Rev. per Inspection (7)	License Rev. per Inspector (8)
Piece Rate	-0.103	-0.195	-0.103	0.130	-0.619	-0.715	-0.845	-0.612
	(0.686)	(0.769)	(0.828)	(0.520)	(0.189)	(0.206)	(0.098)	(0.150)
Piece Rate Tilted	-0.012	-0.276	-0.281	0.086	-0.216	-0.323	-0.407	-0.311
	(0.974)	(0.673)	(0.494)	(0.724)	(0.652)	(0.579)	(0.382)	(0.474)
Difference PR-PRT	(0.632)	(0.890)	(0.697)	(0.833)	(0.236)	(0.305)	(0.110)	(0.283)
Control Mean	1.809	8.290	6.480	8.090	6.854	7.151	-0.939	5.341
Observations	600	572	572	599	600	600	599	600
R^2	0.007	0.011	0.015	0.006	0.050	0.048	0.097	0.058

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the sample of monthly observations for all 2015. All dependent variables are in logs, and month fixed effects are included in all specification.

Table A.6: Balancedness - Inspection Variables

				Large Firms			*Small Firms*		
	Inspected	Gift Common	Evaluation (0-10)	Inspected	Gift Common	Evaluation (0-10)	Inspected	Gift Common	Evaluation (0-10)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Piece Rate	-0.043	0.013	-0.236	-0.012	0.029	0.007	-0.071	-0.003	-0.478
	(0.646)	(0.757)	(0.628)	(0.902)	(0.495)	(0.989)	(0.548)	(0.960)	(0.385)
Piece Rate Tilted	-0.056	0.019	-0.195	-0.031	0.028	-0.091	-0.044	0.019	-0.280
	(0.678)	(0.820)	(0.638)	(0.802)	(0.562)	(0.838)	(0.720)	(0.849)	(0.633)
Difference PR-PRT	(0.840)	(0.839)	(0.917)	(0.796)	(0.948)	(0.861)	(0.772)	(0.634)	(0.700)
Control Mean	0.769	0.087	6.568	0.793	0.090	6.543	0.719	0.079	6.589
Observations	2339	2339	762	1399	1399	467	902	902	286
R^2	0.049	0.030	0.034	0.067	0.032	0.038	0.040	0.052	0.071

Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the baseline sample, restricted to inspected firms in columns (3), (6), and (9). Estimates are conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. In columns (4) to (9), the sample is split between large and small firms, where large firms are defined as those reporting more than one worker, including proprietors, and small firms are the others. The dependent variable in columns (1), (4), and (7) is a dummy equal to one if the firm reports to have been inspected during the intervention period. The dependent variable in columns (2), (5), and (8) is a dummy equal to one if the firm reports that requests of gift, informal payment, or entertainment are common during tax inspections. The dependent variable in columns (3), (6), and (9) is the inspector evaluation score, taking values from 0 to 10.

Table A.7: Balancedness - Business Variables

	Price	Employment	Sales	Revenues	Average Cost	Average Prod. Cost	Average Adm. Cost	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Piece Rate	-0.198	-0.063	-0.068	0.159	-0.191	-0.031	-0.280	0.154
	(0.178)	(0.449)	(0.794)	(0.451)	(0.373)	(0.709)	(0.174)	(0.450)
Piece Rate Tilted	-0.127	-0.093	-0.204	0.214	-0.141	-0.038	-0.205	0.045
	(0.356)	(0.336)	(0.434)	(0.341)	(0.529)	(0.539)	(0.432)	(0.787)
Difference PR-PRT	(0.545)	(0.726)	(0.602)	(0.716)	(0.722)	(0.930)	(0.552)	(0.593)
Control Mean	1.920	0.799	6.265	6.035	1.486	0.678	1.173	5.274
Observations	2031	2301	1393	1563	1188	1188	1214	1552
R^2	0.040	0.143	0.087	0.610	0.147	0.362	0.129	0.555

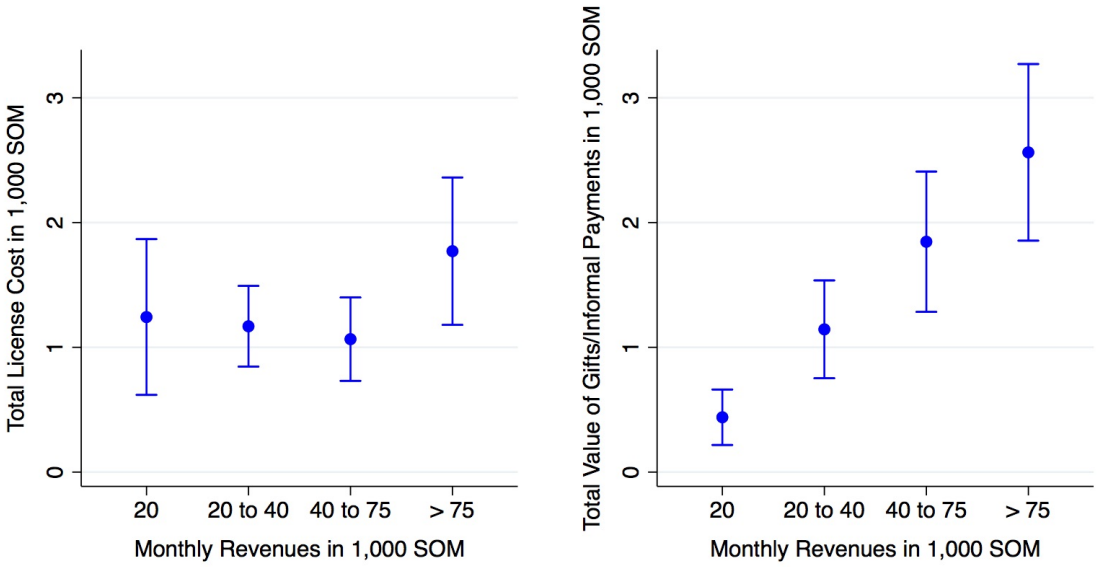
Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full baseline sample, including non-inspected firms, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. Business variables are in log, and the regressions include a dummy that is one when the value of the outcome is equal to zero. The dependent variables in columns (5), (6), and (7) are derived by dividing total revenues by the elicited price of the most sold item in order to derive quantity sold. We then divide total, production, and administrative cost by this quantity to obtain a measure of average cost, average production cost, and average administrative cost.

Table A.8: Balancedness - Business Variables - Inspected Firms

					Large Firms				*Small Firms*			
	Price	Average Cost	Average Adm. Cost	Profits	Price	Average Cost	Average Adm. Cost	Profits	Price	Average Cost	Average Adm. Cost	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Piece Rate	-0.185	-0.238	-0.282	0.214	-0.159	-0.206	-0.298	0.232	-0.188	-0.285	-0.320	0.309
	(0.340)	(0.301)	(0.161)	(0.371)	(0.354)	(0.325)	(0.117)	(0.358)	(0.528)	(0.419)	(0.294)	(0.325)
Piece Rate Tilted	-0.123	-0.146	-0.212	0.032	-0.086	-0.116	-0.201	0.337	-0.092	-0.073	-0.241	-0.130
	(0.504)	(0.367)	(0.292)	(0.846)	(0.552)	(0.544)	(0.322)	(0.083)	(0.714)	(0.691)	(0.223)	(0.549)
Difference PR-PRT	(0.639)	(0.569)	(0.582)	(0.315)	(0.606)	(0.636)	(0.516)	(0.581)	(0.674)	(0.489)	(0.733)	(0.110)
Control Mean	1.889	1.522	1.181	5.282	1.904	1.538	1.107	5.381	1.841	1.443	1.341	5.047
Observations	1511	922	945	1197	942	594	601	741	554	325	341	452
R^2	0.046	0.143	0.125	0.563	0.049	0.135	0.129	0.548	0.063	0.204	0.188	0.619

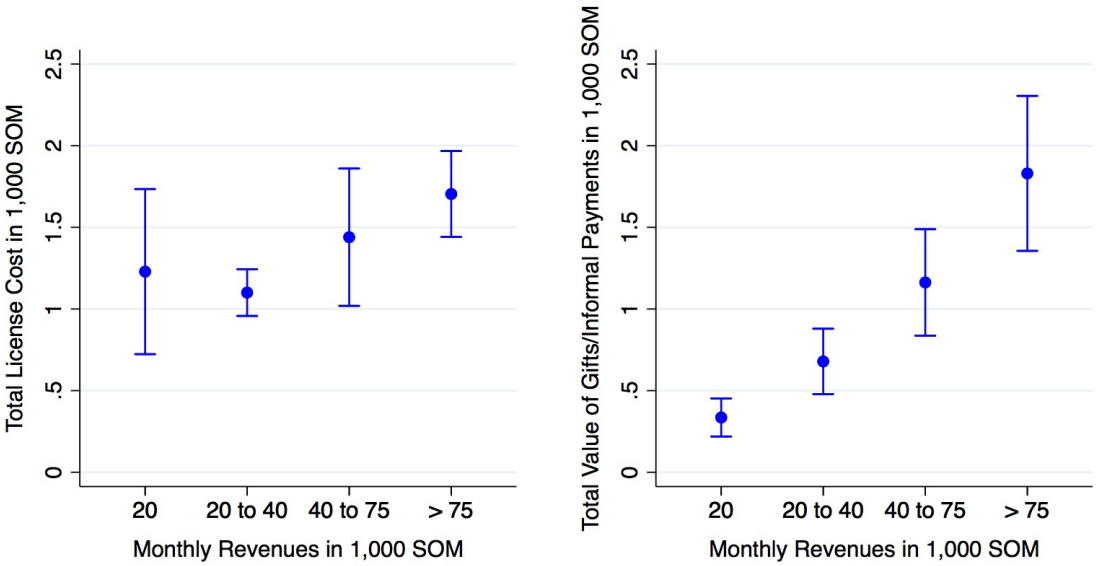
Notes. Wild-bootstrapped p-values in parenthesis, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the baseline sample, restricted to inspected firms, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. In columns (4) to (9), the sample is split between large and small firms, where large firms are defined as those reporting more than one worker, including proprietors, and small firms are the others. Business variables are in log, and the regressions include a dummy that is one when the value of the outcome is equal to zero. The dependent variables in columns (2), (3), (5), (6), (8), and (9) are derived by dividing total revenues by the elicited price of the most sold item in order to derive quantity sold. We then divide total and administrative cost by this quantity to obtain a measure of average cost and average administrative cost.

Figure A.1: License Fees and Gifts/Informal Payments - Bakery



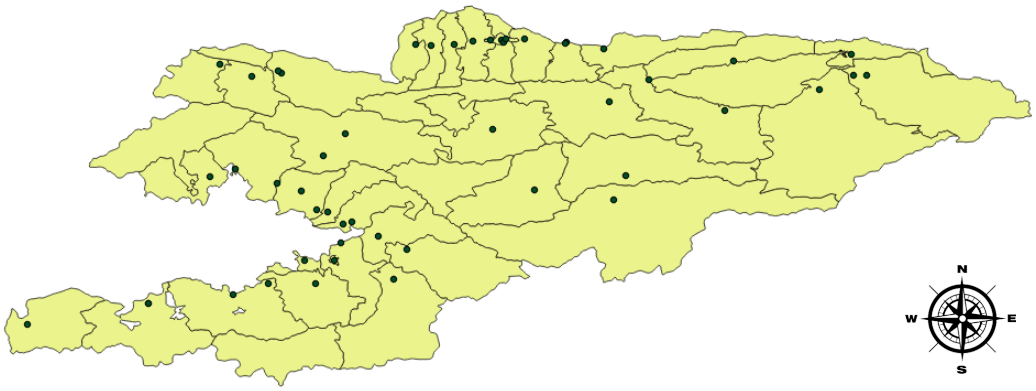
Notes. The figure plots the average total cost of licenses and the average value of gifts/informal payments for firms in the bakery sector as reported in our survey and separately across four revenue categories, together with 95% confidence intervals.

Figure A.2: License Fees and Gifts/Informal Payments - Clothing



Notes. The figure plots the average total cost of licenses and the average value of gifts/informal payments for firms in the clothing sector as reported in our survey and separately across four revenue categories, together with 95% confidence intervals.

Figure A.3: Map of STS Local Offices



Notes. The map shows the location of the 50 STS local offices in the Kyrgyz Republic that take part in our intervention. We exclude the main headquarter office in Bishkek, and 6 other small offices, located in more remote areas. The map also shows the boundaries of districts (raion), the third layer of government after the central and regional one. With few exceptions, STS office catchment areas overlap with district areas.

A.2 Robustness of Modeling Assumptions

This section complements Section 3 by investigating the role played by other possible dimensions of firm heterogeneity, alternative specifications of the evaluation function, and the surplus from the agreement between the firm and the inspector under feedback incentives.

A.2.1 Other Sources of Firm Heterogeneity

In our model, lower demand elasticity maps into both higher revenues and lower relative impact of bribes on profits – and therefore higher evaluation. This subsection investigates what dimensions of firm heterogeneity other than demand elasticity could make the relative impact of bribes on profits lower for larger firms.

Suppose r is the same for all firms, but firms are heterogenous in their marginal cost c. Firms with lower marginal cost would be able to produce higher quantities and make higher profits. In this case, firms' evaluation would still be equal to

$$E = (1-b)^r - 1 \tag{1}$$

and therefore be the same across all firms, as the relative impact of bribes on profits is independent from marginal cost c. No scope for targeting would arise under feedback incentives at equilibrium.

Suppose now that both r and c are homogeneous across firms, but firms face a heterogeneous fixed cost of production equal to F. In this case, all firms would produce the same quantity, and we would not observe differences in firm revenues and therefore bribes paid. In the absence of bribes, those firms with lower F would be making higher profits, and the relative impact of bribes on profits would be lower for these firms. The average cost would also be lower for these firms. The sign of coefficients in column (4) of Table 4 would be consistent with targeting along this dimension, but none of the corresponding estimates is statistically significant. This suggests that this margin of heterogeneity is empirically less salient than heterogeneity in demand elasticity and pass-through.

A.2.2 Evaluation and Absolute Profit Loss

Suppose that the inspector's evaluation E is decreasing in the absolute amount of foregone profits due to bribing, i.e.

$$E = \left[\frac{c}{r-1}\right]^{1-r} r^{-r}\left[(1-b)^r - 1\right] \tag{2}$$

This expression equals the absolute amount of bribe payment. This is higher for firms facing a more inelastic demand. If the inspector's evaluation is proportional to such amount, under feedback incentives the inspector would have even lower incentives to target firms facing a more inelastic demand. This prediction is opposite to the one we derived in Section 3 and contrasts with the evidence that we present in Section 7.

A.2.3 Surplus Under Feedback Incentives

Consider the informal agreement between the firm and the tax inspector under feedback incentives. The utility cost of a single visit for the inspector is fixed and equal to δ. Her payoff also includes an incentive component sE, proportional to the evaluation E submitted by the firm, with $E = (1-b)^r - 1$ and $s > 0$. If an agreement is reached, the inspector receives an additional payoff B from the bribe transfer, and firm profits are equal to $\pi = (p-c)q(p) - B$. If the agreement is not reached, the inspector receives the minimum evaluation, and thus a payoff of $-s - \delta$. The firm loses its revenues together with the cost of production $cq(p)$ incurred in the first stage.

If the inspector reveals the presence of feedback incentives to the firm, the surplus from the agreement includes both the firm's revenues and the variable component of the inspector's bonus payment. The inspector chooses unilaterally the bribe rate b' that maximizes her overall payoff, i.e.

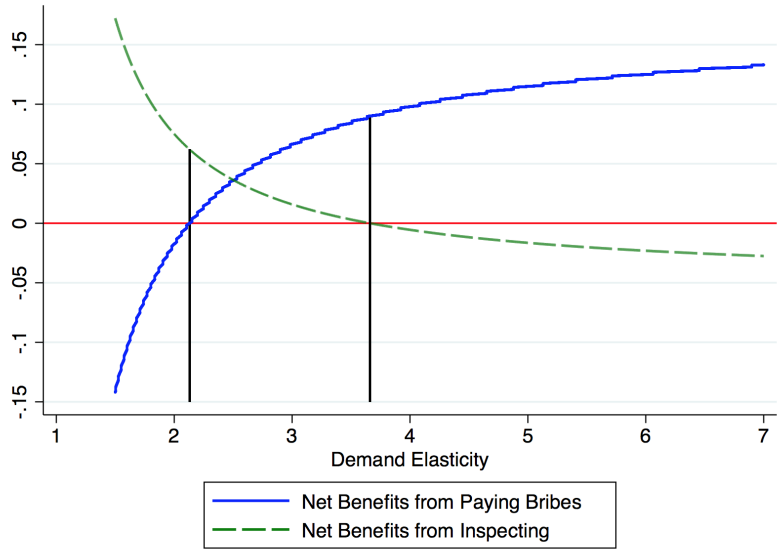
$$b' = \underset{b}{\operatorname{argmax}} \; w + \int_R b \left[\left(\frac{r}{r-1} \frac{c}{1-b} \right)^{1-r} + s(1-b)^r \right] dr - (s+\delta)|R| \tag{3}$$

If instead the inspector does not reveal the presence of feedback incentives, the surplus from the agreement only includes the firm's revenues. The inspector chooses the bribe rate b'' that maximizes her overall payoff, i.e.

$$b'' = \underset{b}{\operatorname{argmax}} \; w + \int_R b \left(\frac{r}{r-1} \frac{c}{1-b} \right)^{1-r} dr + s \int_R (1-b)^r dr - (s+\delta)|R| \tag{4}$$

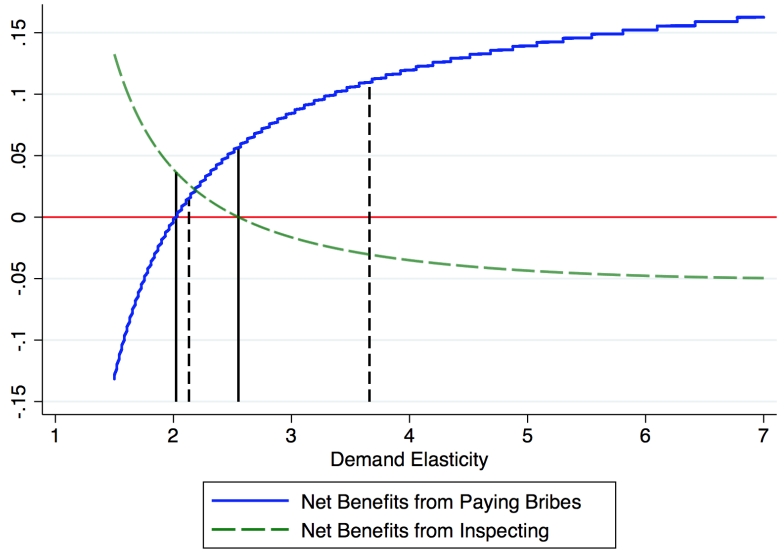
Notice that, upon revealing the presence of feedback incentives, the inspector no longer bears the full trade-off between bribes and evaluation. Indeed, we have that $b' > b''$. Nonetheless, it can be shown that the equilibrium payoff for the inspector is higher in the second case. The inspector is therefore always better off not revealing the presence of feedback incentives to the firm.

Figure A.4: Heterogeneous Bribe Rate - Equilibrium with No Incentives



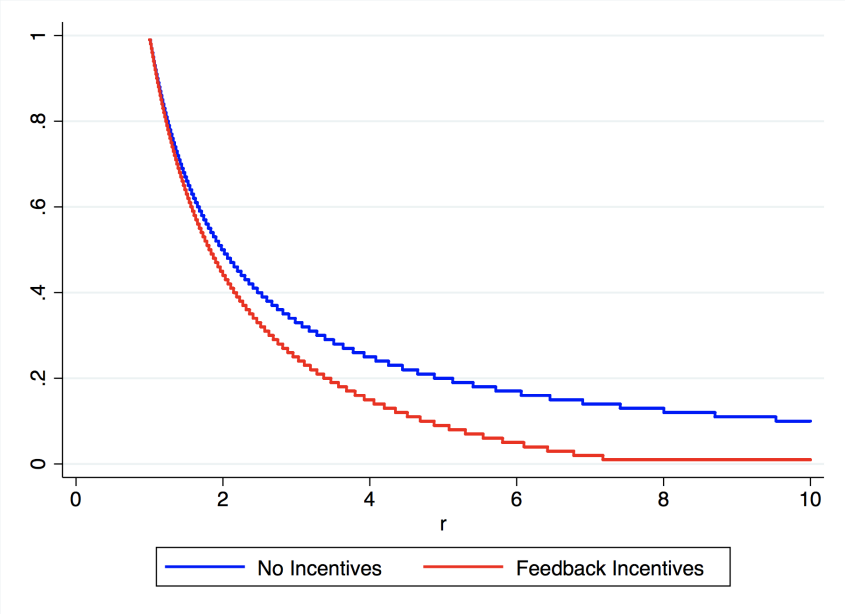
Notes. The figure illustrates the model equilibrium in the absence of feedback incentives in a model where inspectors choose the optimal bribe rate optimally depending on the elasticity of demand faced by the firm. The vertical continuous lines delimit equilibrium set of inspected firms.

Figure A.5: Heterogeneous Bribe Rate - Equilibrium with Feedback Incentives



Notes. The figure illustrates the model equilibrium under feedback incentives in a model where inspectors choose the optimal bribe rate optimally depending on the elasticity of demand faced by the firm. The vertical continuous lines delimit the equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives.

Figure A.6: Heterogeneous Bribe Rates



Notes. The figure plots the equilibrium bribe rate as a function of the elasticity of demand faced by the firm in without and with feedback incentives.