PEDL Research Papers

This research was partly or entirely supported by funding from the research initiative Private Enterprise Development in Low-Income Countries (PEDL), a Foreign, Commonwealth & Development Office (FCDO) funded programme run by the Centre for Economic Policy Research (CEPR).

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Bribes vs. Taxes: Market Structure and Incentives*

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September 24, 2021

Abstract

Firms in low-income countries often avoid paying taxes by making informal payments to tax officials. To decrease these payments, we design an incentive scheme for business tax inspectors that rewards them according to the anonymous evaluation submitted by inspected firms. We show theoretically that incentives decrease the bribe amount, but make firms facing a more inelastic demand more attractive for inspectors. Attaching higher weights to the evaluation of smaller firms limits the scope for targeting. We evaluate both schemes in a field experiment in the Kyrgyz Republic. Our intervention reduces average business costs and prices, and increases tax revenues.

Keywords: taxation, corruption, market structure, demand elasticity.

JEL Codes: D22, D40, H26, H71, O12.

*We are thankful to the Editor Ruben Enikolopov, two anonymous referees, as well as several seminar, conference and workshop participants for their comments. Errors remain our own. We gratefully acknowledge the World Bank WLSME Trust Fund and the CEPR/DFID PEDL initiative for financial support, the EU through the Marie Curie CIG grant FP7-631510 (De Giorgi), and the State Tax Service of the Kyrgyz Republic for data sharing and collaboration. The findings, interpretations, and conclusions expressed in this paper are entirely of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. This study is registered in the AEA RCT Registry with ID AEARCTR-0002882.

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1. Introduction

Firms in poor 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. However, bribes are not necessarily coercive: 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, especially micro and small enterprises. This results in high bribe payments that increase the cost of doing business and negatively affect firm entry, exit, and growth.

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 low-income 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 bribery more attractive for those firms at the margin between paying the bribe or complying with the regulation and paying taxes. Bribery could therefore increase on the extensive margin, and tax revenues could decrease (Khan, Khwaja and Olken 2016).

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. Our objective is to decrease bribe payments by increasing the bargaining power of firms in their relationship with tax officials. We test two variants of the incentive scheme 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, we present 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 this environment, 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 bribery is less detrimental to profits and thus evaluation: those that can pass through more of the cost of bribes to consumers.

These considerations inform 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 disincentivize inspectors from targeting bigger firms with larger passthrough.

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. Results show that, first, firms in both treatment arms are inspected less frequently and report lower bribes. The magnitudes are similar across treatments, but the negative effect on inspections is significant only under the tilted piece rate (PRT) incentive scheme while the negative impact on bribes is significant only under the unweighted piece rate (PR) scheme. Second, inspected firms in both treatment arms report lower average cost and charge lower prices. These effects are significant only under PR incentives, which is where bribes decrease significantly. We interpret the joint decrease in bribes, business cost, and prices as direct evidence of passthrough of bribes to consumers. Finally, tax revenues increase in both treatment arms, and significantly so under PRT incentives, where inspection rates decrease significantly. This is consistent with the hypothesis that officials allow firms to substitute bribes for taxes during inspections.

We provide a number of additional pieces of evidence that are consistent with the theoretical model and its predictions. In particular, the average inspected firm under the PR scheme faces a demand curve that is significantly more inelastic: an indication of larger passthrough. In contrast, we find no evidence of such targeting under the PRT scheme, which discourages the targeting of large firms. The model also predicts a larger decrease in the bribe amount under the PR scheme, consistent with the significant decrease in bribes and prices that we find in the experiment.

Our paper contributes to the literature on corruption, firms, and development.[1] Countries

[1] See Olken and Pande (2012) for a review on corruption in developing 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.[2] 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 a percentage point increase in the bribery rate is associated with a reduction in firm growth that is about three times greater than the one associated with the same increase in tax rate. Sequeira and Djankov (2014) use data on South African firms and show how they 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 bribery 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 focus on a novel and specific margin: the elasticity of the demand firms face and, accordingly, the extent of passthrough of bribes to consumers using prices.

The results in Olken and Barron (2009) also suggest that changing the organization of the bureaucracy and increasing its efficiency is key in order to address corruption. One possible 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 rather than

[2]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).

property 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 low-income countries (Dal Bó, Finan and Rossi 2013; Ashraf, Bandiera and Jack 2014; Finan, Olken and Pande 2017; Rasul and Rogger 2018; Best, Hjort and Szakonyi 2017; Deserranno 2019; Deserranno, Kastrau and Léon-Ciliotta 2021; Caria, Deserranno, Kastrau and Léon-Ciliotta 2021).

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 introduces our sampling strategy and data. Section 4 presents the theoretical model. Sections 5 discusses the design of our intervention while Section 6 presents the results. Section 7 shows additional evidence that supports the model and rules out alternative explanations. 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. Formerly part of the Soviet Union, 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 it is valid, and its cost is the only transfer the business makes to the tax authority. The cost varies between 7 and 210 USD approximately, depending on sector of activity, size of the business, and its location. The last category of business tax payers 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 targeted 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 disproportionally target 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. Data and Descriptives

We constructed a sample that is representative of the firm population of interest within the catchment area of each local STS office. We started from an initial list of 10,000 businesses provided by STS which helped us identify the typical ever listed firm in the catchment area of each local tax office. This initial list was compiled to accommodate our focus on individual entrepreneurs and, as such, 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 a target sample of firms according to their tax regime category, turnover size, sector of activity, and local tax office. We then drew one fourth of the

businesses in each stratum, getting to a target baseline sample of 2,510 firms. We used this target sample to discipline a sampling procedure whereby we filled the various strata by visiting local markets.

We carried out the baseline survey in March and April 2016. 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 balance 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 the inspector's evaluation is 6.5 out of 10.[3] Eliciting firms' engagement in informal relationships with tax inspectors can be challenging. We do it 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. Profit margins may seem high, however they are not far off those reported by McKenzie and Woodruff (2014) in their survey article. In a large

[3] Around 43% of inspected firms at baseline provide an evaluation. A possible reason for this is that at baseline firms are asked about inspections over the whole last year while in the follow-up survey they are asked about inspections over the last two months that cover the intervention period.

[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.

number of cases they are to be interpreted as owner compensation for labor given that about 40% of the surveyed businesses are one-person firms. 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 costs 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 meant to build a panel of firms, but rather a repeated cross-section of firms within the local STS office catchment areas. This is because we expected that the composition of inspected firms would change with the treatment, and providing evidence of this selection mechanism is core to our study.

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 bribery decreased along all these margins.

Given the focus on passthrough, we also 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 would the quantity sold 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 and Dinerstein 2020). 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. Section 7 presents several pieces of evidence that validate this measure.

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 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.

We start our empirical analysis by exploring whether 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 gifts, informal payments, 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 parentheses.[5] 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 use the log of the number of workers and proprietors as the regressor. Columns (3) to (5) show that firms reporting gifts or informal payment requests during inspections have significantly higher sales, revenues, and profits than other firms. These results altogether show that the incidence of inspections and bribes is systematically higher among larger firms.

4. Model

Inspectors choose which firms 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 passthrough – 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 $c \geq 1$. Firms operate under monopolistic competition in different markets with varying degrees of product differentiation. Each one of them thus 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 which maps directly into heterogeneity in the extent of passthrough.[6]

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

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

[6] We have also experimented with a different demand function, $q = (a - p)^{\delta}$. This is a constant, δ, passthrough demand. The main insights of the current approach with iso-elastic demand are unchanged. Moreover, in Appendix A.2.1, we investigate theoretically other possible dimensions of firm heterogeneity such as marginal and fixed costs and show that they do not confound our main theoretical results and interpretation of the data. Finally, in Section 7, we present evidence that supports the assumption of an iso-elastic demand curve. In particular, the bottom of Table A.1 shows the average drop in quantity sold following a 5, 10, and 20% price increase, which is equal to 4.9, 9.14, and 16.63% respectively. Evidence thus supports the assumption of an iso-elastic demand curve, with average elasticity of demand across firms equal to 1.

therefore a fixed cost.[7] 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 markup over marginal cost. The elasticity of demand firms face shapes the size of markup and the extent of passthrough of changes in the marginal cost to consumers using prices. Firms facing a more inelastic demand have higher markups and larger passthrough, charge higher prices, and have higher revenues and profits.

Firms and inspectors interact repeatedly over an infinite number of periods. Within each period, 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 foregoes its revenues on top of the cost of production $cq(p)$ incurred in the first stage. It follows that 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. Notice that this does not necessarily imply that bribing in this model is exclusively coercive in nature as opposed to collusive: in the first stage, firm choose whether to comply

[7] 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).

with the regulation and pay taxes or to expose themselves to bribe requests. Without loss of generality, we assume that b is constant across firms.[8]

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 passthrough 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 $\tilde{\pi} \geq \pi^*$ as specified in equations 6 and 2 respectively. 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. Firms facing a more inelastic demand have higher revenues and are therefore less willing to substitute the variable cost of bribes for the fixed cost of taxes. This is despite them being able to pass through more of the cost of bribes to consumers, with relatively lower impact on their profits.

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

[8] 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. Section 7 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%. Bai, Jayachandran, Malesky and Olken (2017) use data from the World Bank Enterprise Survey and Vietnamese firm-level data to show that the amount of bribes increases with revenues, although its share is decreasing.

[9] As reported in Section 3, 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 and we have very little information about the inspectors aside from their number.

4.1. 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.

The equilibrium is defined by a bribe rate b^* and a set of inspected firms R^*. At equilibrium, (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.

The one-to-one mapping between inspections and bribes is an equilibrium result. In this 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. Nonetheless, the model can easily accommodate the existence of two types of inspectors, a fraction of them behaving as just described, and the rest being committed to not engaging in informal relationships with inspected firms. In the absence of strategic interactions between the two types, our intervention would change the incentives and behavior of the former type only. In other words, as long as some inspectors behave as just described, the mapping between the model and the empirics remains. Yet, the formalization we propose is also a good approximation of the environment we are interested in, characterized by low accountability, inefficient organization in the bureaucracy, and poor enforcement.

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 bribery 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 bribery for the firm and the net benefits of visiting for the inspector are positive: an inverse U-shaped relationship exists between demand elasticity and probability of inspection and bribery. The higher the license fee, the lower the average demand elasticity among inspected firms.

4.2. *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 bribery, which turns out to be equal to[10]

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

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 passthrough 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. $\partial^2 E/\partial b \partial r < 0$.[11]

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 $\hat{R}$.[12]

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 it optimal

[10] 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 $\left[\frac{c}{r-1}\right]^{1-r} r^{-r}$.

[11] In Section 7, 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 5.

[12] Notice that, under feedback incentives, the bribe is still a fixed proportion b of firm revenues. 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 bears 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.

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 the 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. On the other hand, 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.[13]

4.3. 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 larger 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 disproportionally targeting larger firms facing a more inelastic demand. This is because the larger passthrough 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 passthrough – firms reduces the incentives for inspectors to target firms facing a less elastic demand. Such tilted schemes limit 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.

Before concluding, note that, unless we make specific assumptions on the shape of the demand elasticity distribution across firms, the model delivers no prediction on the impact of feedback incentives on the overall frequency of inspections. 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

[13] As anticipated, 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.

not necessarily the case if, for example, firm density is decreasing (or locally decreasing) in r.

5. 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 suggests that inspectors would respond to feedback incentives along the extensive margin and target firms with larger passthrough. To counteract this effect and limit the scope for targeting, we also implemented as a 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.

As in the model, and in both treatment arms, the bonus awarded to inspectors is a piece rate that increases proportionally with the anonymous evaluation submitted by inspected firms. Yet, because there is no information available on the identity of the inspector that visited each firm, we link the bonus to the average evaluation submitted by inspected firms in the entire office's catchment area. Furthermore, in the model the bonus increases with the *sum* of firm evaluations while in the version we implement it increases with the *improvement* in *average*

evaluation. This is because we want to net out variation across offices in initial conditions that could affect the power of incentives. For instance, offices that are responsible for a higher number of firms count more inspectors, do more inspections, and mechanically have a higher sum of firm evaluations. Similarly, the average evaluation submitted by firms at baseline varies across offices because of differences in monitoring, accountability, or inspectors' characteristics. Using the improvement in average evaluation as the relevant metric allows us to account for these differences, and make the strength of incentives more comparable across offices. Notice also that the denominator in the formula in equation 10 takes into account that offices with better evaluations at baseline have less room to increase their compensation as the improvement is calculated relative to how far the baseline value was from 10. Finally, we only consider improvements for the bonus, i.e. we do not penalize inspectors for negative changes in average evaluation because that would have required further adjustments to the fixed component of wages that STS was unwilling to make.

The focus on firm size when weighting evaluations in the tilted scheme follows closely from the model, where the elasticity of the demand they face is the only dimension of firm heterogeneity and maps one-to-one to revenues and the extent of passthrough. Indeed, the firm's market power correlates strongly with firm size and is a determinant of passthrough (Bain 1951). We set weights according to the number of workers as proxy for firm size because other business variables are typically measured with less accuracy. Moreover, the number of workers fluctuate less over time and, as such, is likely to better proxy for the deep determinants of firm size we are interested in, i.e. market power and demand elasticity.

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 and their split between treatment arms. We stratified the randomization according to baseline inspection rates per office, and verified ex-post the balance of baseline observable firm-level characteristics. We test for balance 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 equal to one if the firm is located in Bishkek.[14] v_{ig} captures residual unobserved determinants of Y_{ig}.

[14]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.

Table A.3 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, with p-values in parentheses. 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 balance out of the 24 tests summarized in the table.

Table A.4 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, with p-values in parentheses. 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 reported prevalence of gift or informal payment requests. This is also true within the categories of large and small firms as defined by whether they report more than one worker, including proprietors. Table A.5 shows that the same is true for business variables.[15]

6. Experimental Results

6.1. Inspections, Bribes and Evaluations

Given the design of our experiment we focus first on the outcomes that should be directly affected: inspections, bribes, and firms' evaluations. We therefore test whether our intervention has any impact on the likelihood that tax officials inspect a given firm. For all firms in the post-intervention sample, we define a dummy equal to one if the firm reports to have been inspected during the intervention period. We place this dummy as the dependent variable in equation 11 and implement the corresponding regression specification, controlling for the stratification variables and clustering the standard errors at the local tax office level.[16] Column (1) of Table 2 reports the resulting coefficient estimates with p-values in parentheses. We show that feedback incentives lead to fewer inspections. In particular, the probability of inspection is 18.4 percentage points lower under PRT incentives, that coefficient being statistically significant at the 10% level. For the PR arm we find a negative effect of similar magnitude, 15.5 percentage points, however the estimate is imprecise. Those effects are substantial as the control mean for

[15] Table A.6 in Appendix A.1 shows evidence of balance of business variables among inspected firms as well.

[16] As explained before, given the low number of clusters and high heterogeneity in the number of observations per cluster, we obtain wild-bootstrapped standard errors (Mackinnon and Webb 2017).

inspection is 68.3% and the effects are therefore about 25% of the control mean.

In column (2), we implement the same regression specification but replace the dependent variable with 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 18 to 19 percentage points more likely to report a reduction in bribery along all these margins. Point estimates are similar across the two treatment arms, but significant at the 10% level only under PR incentives. These effects are quite sizeable as they amount to about 45% of the control mean.

Feedback incentives should increase the evaluation submitted by inspected firms. To test this hypothesis, we restrict the sample to inspected firms – the only ones submitting evaluations – and regress the evaluation score on the treatment indicators and the usual set of controls. To match the incentive formula in equation 10, we build the evaluation score variable for this regression by taking the difference between the evaluation submitted by the firm and the average evaluation at baseline, divided by the difference between 10 (the maximum score) and the latter (the baseline evaluation). Column (3) reports the corresponding coefficient estimates. Inspected firms in treatment arms give higher evaluations than firms in the control group, significantly so at the 10% level under PR incentives. The point estimate of the PRT dummy coefficient is positive as well, indicating better evaluation score, but it is not significant at conventional levels.

Taking stock of the direct outcomes reveals that our intervention resulted in fewer inspections, fewer bribes, and higher evaluation scores. However, there are important reasons to believe that these effects are heterogeneous across firms of different size. In particular, given its weighting feature, larger firms should be inspected less under the PRT scheme. Columns (4) to (9) of Table 2 report the coefficient estimates that we obtain from implementing the same regression specifications separately for the sub-samples of large and small firms. We define large firms as those reporting more than one worker, including proprietors. As mentioned previously, one-person firms account for around 40% of our sample, and the average number of workers across firms and survey waves is equal to 2.72. We use the number of workers as proxy for firm size as this is typically measured more accurately than other business variables. Results show that the effects reported in columns (1) to (3) are driven by large firms. As expected, large firms are significantly less likely to be inspected under PRT incentives. This is because the weighting scheme attaches a lower weight to their evaluations in the bonus formula. Large firms are also those that report significantly lower bribes and submit significantly higher evaluations under PR incentives.

This first set of experimental results shows that unweighted feedback incentives increase the evaluations submitted by firms and reduce bribes, but do so significantly only among large

firms. Attaching more weight to the evaluation submitted by small firms discourages officials from inspecting larger firms. This significantly decreases the overall incidence of inspections, but does not systematically affect evaluations or bribes.

These findings are consistent with our model: unweighted feedback incentives prompt officials to inspect larger firms that report lower bribes and submit higher evaluations. This targeting and composition effect is instead muted when evaluations are weighted and larger firms are attached a lower weight in the bonus formula.

6.2. Prices and Business Cost

If bribes are passed-through to consumers using prices, feedback incentives should also reduce the price inspected firms charge to consumers. Table 3 shows the estimated treatment effects on a specific set of business variables for all inspected firms, and then separately for large and small firms, with p-values in parentheses. We consider as dependent variables the log of price, average cost, administrative cost, and profits. Under feedback incentives, inspected firms charge lower prices. The effect is significant at the 5% level under PR incentives, paired with a significant negative treatment effect on average total cost and average administrative cost. The same point estimates are lower in magnitude and non-significant under PRT incentives. The effect on profits has opposite signs across the two treatment arms, and always insignificant.

The significant negative effect of PR incentives on prices and business cost is driven by large firms. We interpret the results in Table 3 and Table 2 altogether as evidence that feedback incentives reduce the bribe amount, and that this cost reduction is passed-through to consumers using prices. The targeting of large firms suggested above may confound this interpretation of results, a possibility that we explore in details when testing the full model assumptions and predictions in Section 7.

6.3. Tax Offices: Inspections, Licenses and Tax Revenues

Lastly, we evaluate impact at the local office level looking at the number of inspections, licenses, and tax revenues. These are administrative data provided to us by STS. Table 4 shows evidence of the effects of our intervention on these outcomes. 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.

We consider as dependent variables the overall number of inspections as reported by the administration, the number of registered licenses, the revenues from licenses, and revenues per reported inspection, all in logs. The table reports coefficient estimates and p-values in parentheses. The third column of Table 4 shows that our intervention increases revenues from licenses, significantly so at the 10% level under PRT incentives. According to our estimates, revenues from licenses increase differentially by 4.8 percent in this treatment arm. This piece of evidence is consistent with the the results in Table 2 showing a significant decrease in inspections reported by firms. We interpret this as indicative that officials during inspections allow firms to substitute bribes for taxes: a reduction in inspectors' activity along the extensive margin is associated with an increase in tax revenues from licenses.

7. Additional Evidence Supporting the Model

7.1. Validation of Modeling Assumptions

We now present further evidence that speaks to the mechanism highlighted in the model and the role of demand elasticity in shaping the relationship between firms and business tax inspectors. We start by investigating the relationship between self-reported (elicited) measures of firm-level demand elasticity and firm characteristics. First, the bottom of Table A.1 shows the average drop in quantity sold following a 5, 10, and 20% price increase, which is equal to 4.9, 9.14, and 16.63% respectively. Evidence thus supports the assumption of an iso-elastic demand curve. Firms facing a more elastic demand should face more competition. Indeed, Table A.7 in Appendix A.1 shows that the reported elasticity of demand increases with the number of competitors. We construct a variable representing the number of competitors by counting the number of surveyed firms in the same narrowly defined sector and market. 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%), café (2%), beauty salon (2%), pharmacy and sale of related products (2%). Finally, firms facing a more elastic demand should charge lower prices. We provide such evidence in Table A.8 in Appendix A.1, where we estimate a negative (though imprecise) relationship between elasticity and prices.[17]

Second, firms facing a more inelastic demand should have larger market shares and higher revenues and profits. Evidence shows that the elicited demand elasticity measures correlate

[17]Columns (1) to (3) of Table A.8 in Appendix A.1 show that demand elasticity is negatively correlated with prices, although the corresponding coefficient estimates are not significant. In columns (4) to (6), we use the same measures of elasticity to calculate the log of markup, and substitute the latter for the elasticity measure in the price regression. Estimates show that markup is positively correlated with the price charged to consumers, even if again not significantly so.

with business variables as specified in the model. Columns (1) to (3) of Table 5 show that firms reporting a more inelastic demand are systematically larger. Column (4) shows that larger firms also have higher average business costs, something we discuss in depth later on. Perhaps most importantly, and in line with the results in Table 1, columns (5) to (7) of Table 5 show that demand elasticity is significantly negatively correlated with the incidence of gift or informal payment requests. Column (8) shows that while correlated with firm size – as shown in column (4) of Table 5 – higher average costs does not map systematically into higher or lower incidence of gifts or informal payment requests. This further validates the model's focus on demand elasticity rather than cost as the relevant margin of firm heterogeneity.[18]

Third, in the model license fees are a fixed cost while the bribe amount increases 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.[19] The left graph of Figure 4 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, i.e. licenses appear to be fixed costs. The right graph of Figure 4 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.[20] 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, the model assumes that the evaluation of inspectors decreases with the amount of bribes paid. Specifically, we assume that evaluations decrease with the fraction of forgone profits due to bribery. Two pieces of evidence validate this assumption. First, Table 6 shows that reporting gift or informal payment requests is systematically and 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%*

[18] 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.

[19] 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.

[20] 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 payments requested by tax officials?*

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 modelling assumptions. In particular, it highlights the crucial role of demand elasticity in shaping both sides of the relationship between firms and business tax inspectors.

7.2. Targeting

Our 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. While being not fully informed about such elasticity, inspectors can have information on its correlates and how these map into the extent of passthrough that firms have. For example, they can observe firm size or the number of competitors in the local market, and we have shown earlier how the elicited elasticity measures correlate positively and significantly with the number of competing firms.

Figure 5 plots the unconditional distribution of demand elasticity among all firms in the control group, and the same distribution among inspected firms only. Consistent with the model, we show 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. The results from a Kolmogorov-Smirnov test of equality of distributions indicate that we can reject at the 1% significance level the null hypothesis that the distribution of demand elasticity is equal between inspected and non-inspected firms.

The model also delivers predictions on how feedback incentives prompt inspectors to target different firms. Under PR incentives, inspectors should target disproportionally larger firms, i.e. those facing a more inelastic demand, while this effect should be muted under PRT incentives. These theoretical predictions are matched by the experimental evidence. Similarly to Figure 5, Figure 6 shows the unconditional 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.

These results are formally validated by a set of Kolmogorov-Smirnov tests of equality of distributions. We can reject at the 1% significance level the null hypothesis that the distribution of demand elasticity is equal between inspected firms under PR and inspected firms in the control group. Importantly, we can also reject at the 10% significance level that the distribution of demand elasticity is equal between inspected firms under PRT and inspected firms in the control group. This indicates that the tilted scheme successfully incentivizes inspectors to visit smaller firms that face a more elastic demand.

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 the inspection dummy and the elasticity of demand separately on the stratification variables and other controls as specified in the discussion of equation 11.[21] Consistent with Figure 5, 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 graph 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. At the same time, the right graph shows that the tilted scheme prompts inspectors to visit firms that face a more elastic demand. The conditional probability of inspection is closer to the one observed in the control group for low and moderate values of elasticity, and higher than in the control group for firms facing a more elastic demand.

These patterns are confirmed in a standard regression framework. Table 7 reports coefficient estimates and p-values in parentheses from the regression specification in equation 11, having as dependent variable the elasticity of demand faced by the firm. We restrict the sample to those firms that report to having been inspected during the intervention period. In the first column, the dependent variable is an average across the elasticity measures derived by asking about the percentage change in quantity sold following a price increase of 5, 10, and 20%. In columns (2) to (4) we consider these three different measures separately. Evidence shows

[21] Notice that the size variable we use for stratification is a set of dummies for different annual revenue categories: between zero and 1million Kyrgyz SOM, between 1 and 4millions, between 4 and 30 millions, and over 30 millions. These correspond to monthly revenue categories: between zero and 83,300 Kyrgyz SOM, between 83,300 and 333,300, between 333,300 and 2.5millions, and over 2.5 millions. Given how large the intervals of these revenue categories are, we can still rely on large residual variation in the elasticity of demand across firms.

that the average elasticity of demand faced by inspected firms is significantly lower under PR incentives compared to the control group. The corresponding estimate in column (1) is statistically significant at the 5% level, and is still significant at the 10, 5, and 1% level respectively when considering the three elasticity measures separately in columns (2) to (4). Importantly, the difference between the average demand elasticity faced by inspected firms in PR is also significantly lower than under PRT, with the corresponding estimate being statistically significant at the 10% level when considering the pooled elasticity measure. In column (5), we replace the dependent variable with the log of the average business cost, which we found to be positively correlated with firm size. We do not find evidence of systematic targeting along this margin, validating once again the key role of demand elasticity and passthrough emphasized in our theoretical framework.

The model also predicts that feedback incentives decrease the bribe rate and the price that inspected firms charge to consumers. This is consistent with the evidence we present in Section 6. A possible concern is that the targeting of firms on behalf of inspectors induces a bias in the estimates of the effect of our intervention on prices. This is because the average firm inspected under PR incentives is systematically different. However, Table 7 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 passthrough – 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.

7.3. Alternative Explanations

Fixed License Fee vs. Proportional Bribe In our model, the license fee is fixed while the bribe amount increases proportionally with revenues. A natural question is why the equilibrium illicit agreement does not involve a bribe payment that is fixed and just below the value of the license. In the model this is not sustainable because by the time the inspector visits the firm the tax compliance decision has been already made, and the inspector is better off requesting a bribe that is proportional to firm revenues. Firms anticipate this in the first stage and sort into paying taxes or not accordingly. In reality, the sequence of events may be different.

Yet, Figure 4 and Figure A.1 and A.2 in Appendix A.1 provide direct evidence that bribes increase proportionally with revenues while license fees do not. More importantly, if the bribe payment was just below the value of the license and unrelated to firm size, there would be no reasons for inspectors under feedback incentives to target differentially firms of different size or facing a more inelastic demand.

Evaluations Still, some firms may be more willing than others to submit high evaluations. These firms may be those that are more established, that the inspectors have known for longer and with whom they can enter a gift exchange, relational type of arrangement trading off tax evasion for good evaluations. These are the large firms that inspectors target for inspections and bribes differentially more once feedback incentives are in place. This scenario is completely consistent with our interpretation of results. The purpose of our model and empirical analysis is to understand *why* certain firms are more willing than others to engage in bribing relationships with tax officials or engage in long-term relationships with them. We highlight the role of passthrough, using the elicited measures of demand elasticity as proxy.

Bargaining In our model, the evaluation is not part of the bargaining between the firm and the inspector. As we show theoretically in Appendix A.2.3, the inspector is always better off not revealing the presence of feedback incentives to the firm. This explains why the additional component of the 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 reality, however, information may be revealed and the evaluation become part of the bargaining. Once again, this does not affect our model implications and interpretation of results as firms with larger passthrough would still be differentially more willing to engage in bribing relationships and submit differentially higher evaluations.[22]

Finally, in the model the inspector unilaterally chooses the share of surplus that maximizes her utility, i.e. has all the bargaining power when inspecting non-compliant firms. This may not necessarily be the case. In particular, one may expect larger firms to have more bargaining power. If that was the case, however, inspectors would respond to unweighted feedback incentives by targeting for inspections differentially more the smaller firms from which it would be easier to elicit higher evaluations. This is the opposite of what evidence shows.

8. Conclusions

Bribe prevalence is much higher among firms in poor than in rich countries; and there is still limited evidence on policies that can reduce bribe payments in the typical poor country environment characterized by 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

[22] In particular, it is possible that the targeting of large firms under feedback incentives occurs, but this is not accompanied with a reduction in actual bribes paid. This is exactly the case we discuss theoretically towards the bottom of Section 4.2, where we keep the bribe rate fixed and equal to the equilibrium one of no incentives, and investigate the inspector's targeting response. Yet, Table 2 shows that large firms report significantly lower bribes under PR incentives, and the evidence on price an costs in Table 3 is also suggestive of lower bribe amounts

average evaluation submitted by inspected firms, our intervention strengthens the bargaining position of firms in their relationship with tax officials. We use a simple model to elicit predictions on how such an incentive scheme interacts with firm heterogeneity and market forces. In particular, we show and test how market forces shape the firms' willingness to engage in bribing relationships, and that inspectors take these margins into account in their activity. Our findings are consistent with the main model predictions: under feedback incentives, inspectors target disproportionally firms facing a more inelastic demand that then can 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 providing also additional evidence on the relevance of the theoretical mechanism.

Our study delivers two main findings. First, market structure and firm heterogeneity in the extent of passthrough matter in shaping the bribery incentives of firms and 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, meaning corruption that affects firms will decrease consumer welfare. This has implications for who faces the burden of corruption (Bardhan 1997). In 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 parentheses, 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 gifts, informal payments, or entertainment are common during tax inspections.

Table 2: 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 parentheses, 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 3: 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 parentheses, 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 4: 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 parentheses, 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.

Table 5: 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 parentheses, 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 6: 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

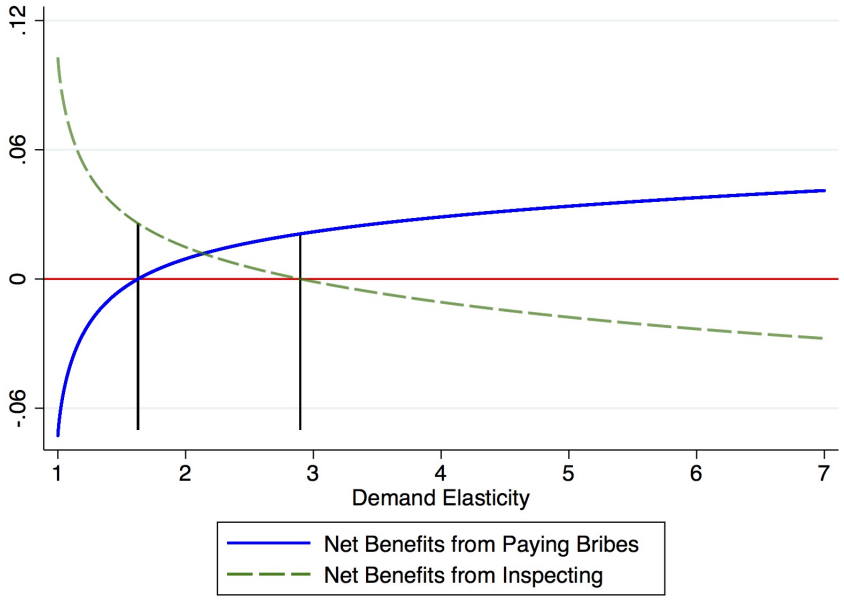
Notes. Wild-bootstrapped p-values in parentheses, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. The dependent 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 7: Intervention - Characteristics of Inspected Firms

	Elasticity	Elasticity_5	Elasticity_{10}	Elasticity_{20}	Average Cost
	(1)	(2)	(3)	(4)	(5)
Piece Rate	-0.291	-0.235	-0.326	-0.333	-0.160
	(0.022)	(0.080)	(0.028)	(0.007)	(0.161)
Piece Rate Tilted	-0.045	0.051	-0.095	-0.134	0.020
	(0.731)	(0.653)	(0.531)	(0.432)	(0.904)
Difference PR-PRT	0.092	0.035	0.146	0.197	0.276
Control Mean	0.895	0.859	0.927	0.887	0.659
Observations	1418	1365	1388	1385	1375
R^2	0.072	0.067	0.074	0.095	0.048

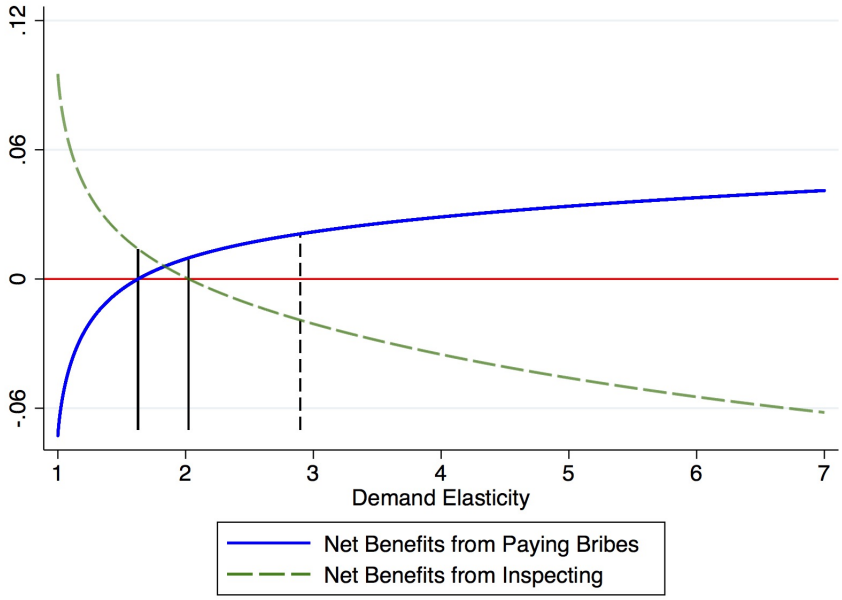
Notes. Wild-bootstrapped p-values in parentheses, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek. The dependent variable in columns (1) to (4) is derived from 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 (1) is averaged across the corresponding three measures, while these are considered separately in columns (2) to (4). The dependent variable in column (5) 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.

Figure 1: Equilibrium with No Incentives



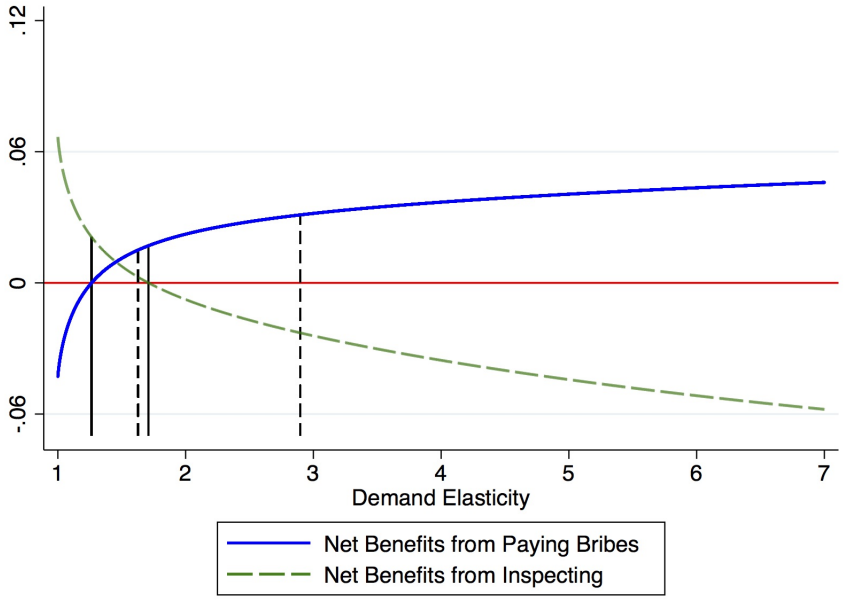
Notes. The figure illustrates the model equilibrium in the baseline case of no feedback incentives. The vertical continuous lines delimit equilibrium set of inspected firms.

Figure 2: Equilibrium with Feedback Incentives and Fixed Bribe Rate



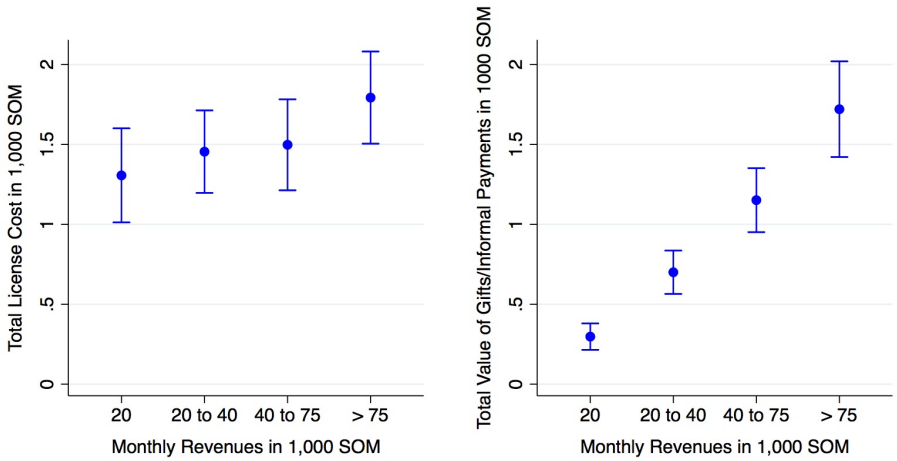
Notes. The figure illustrates the model equilibrium in the case with feedback incentives but constant bribe rate. The vertical continuous lines delimit the equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives.

Figure 3: Equilibrium with Feedback Incentives



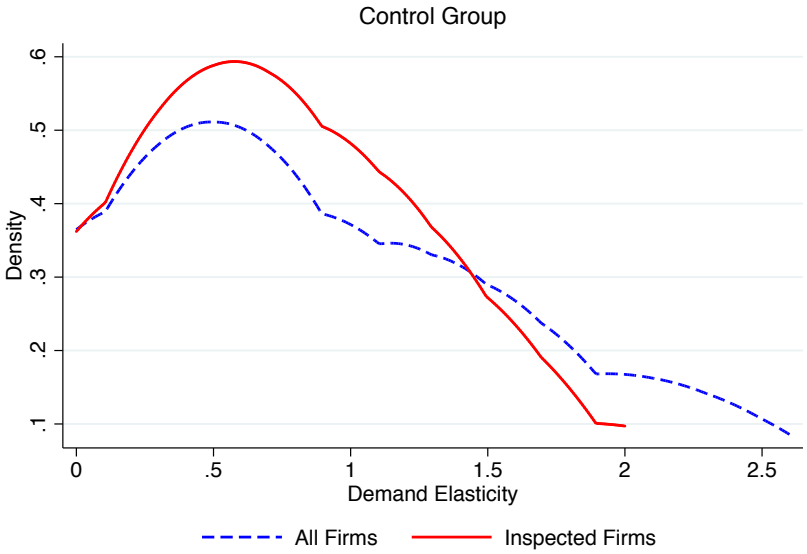
Notes. The figure illustrates the model equilibrium in the case with feedback incentives and optimally chosen bribe rate. The vertical continuous lines delimit the equilibrium set of inspected firms, while the vertical dashed lines delimit the previously derived equilibrium set in the case of no incentives.

Figure 4: 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 5: Inspections and Demand Elasticity

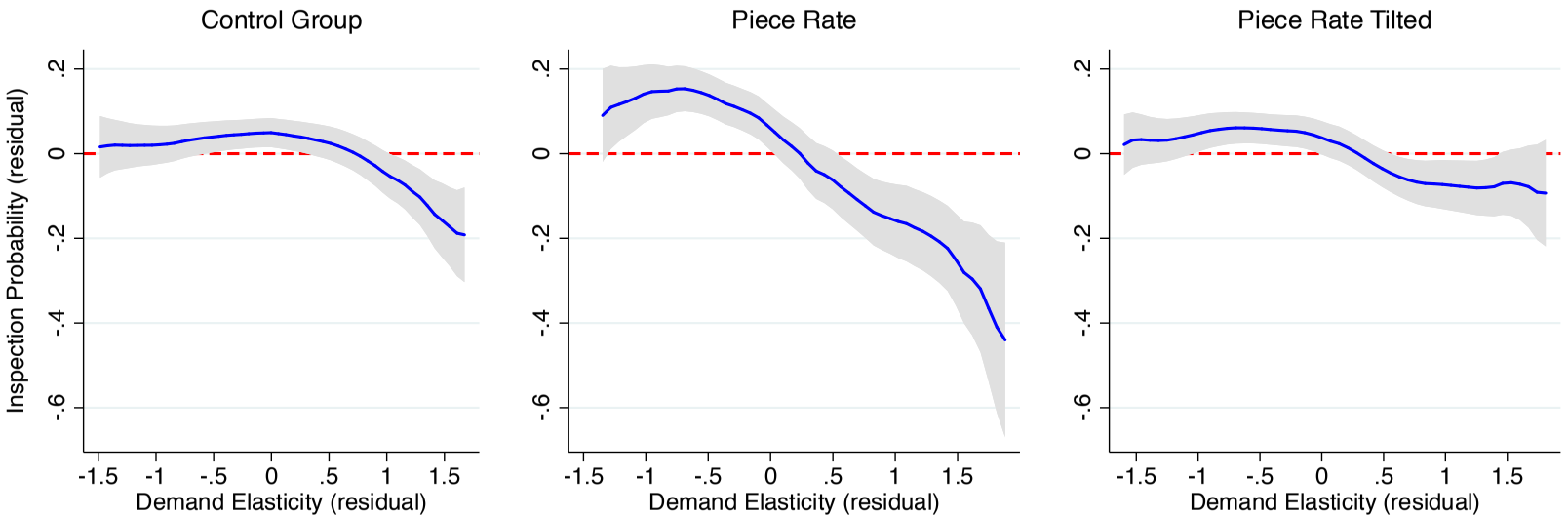


Notes. The figure plots the distribution of the elasticity of demand separately among all firms and among inspected firms only. Demand elasticity is derived from the answer to the question: *Suppose that the market price of such product or service increased by 5%. By how much the quantity sold would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

Figure 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: Balance - 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 parentheses, 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.4: Balance - 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 parentheses, 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.5: Balance - 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 parentheses, 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.6: Balance - 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 parentheses, 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.

Table A.7: 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

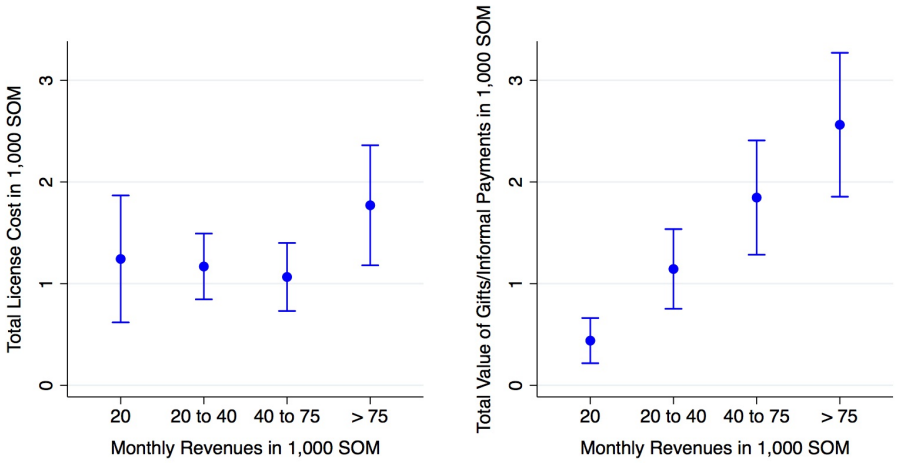
Notes. Wild-bootstrapped p-values in parentheses, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the post-intervention sample, restricted to observations outside Bishkek. The dependent variables in columns (1) to (3) are defined according to 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.8: 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

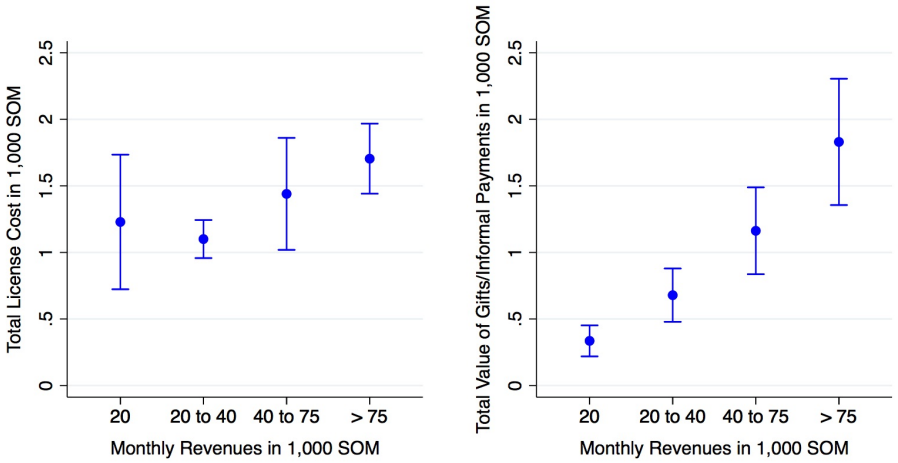
Notes. Wild-bootstrapped p-values in parentheses, clustering standard errors by location as defined by the catchment area of each tax office. Estimates over the full sample, and conditional on stratification variables: size, tax regime, STS office group, sector, and a dummy for Bishkek.

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



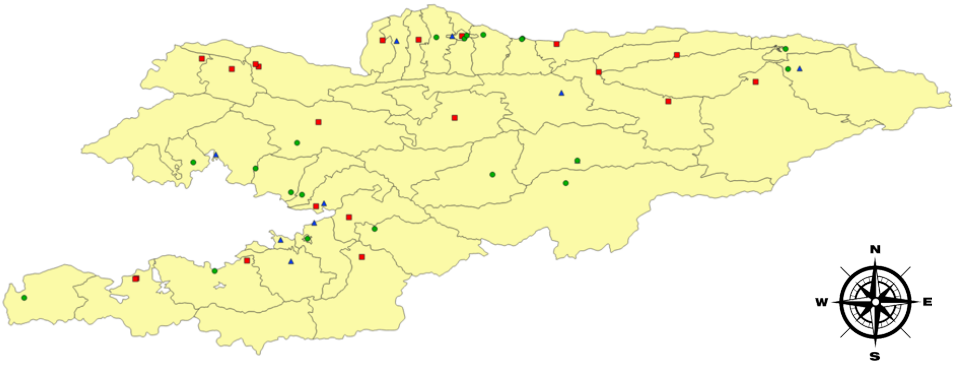
Notes. The figure plots the average total cost of licenses and the average value of gifts/informal payments for firms in the bakery sector as reported in our survey and separately across four revenue categories, together with 95% confidence intervals.

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 and their split between assigned to the control group (circles), assigned to the unweighted PR scheme (squares), and assigned to the PRT scheme (triangles). 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 4 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 7 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 passthrough.

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 bribery, 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 4 and contrasts with the evidence that we present in Section 6.

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.

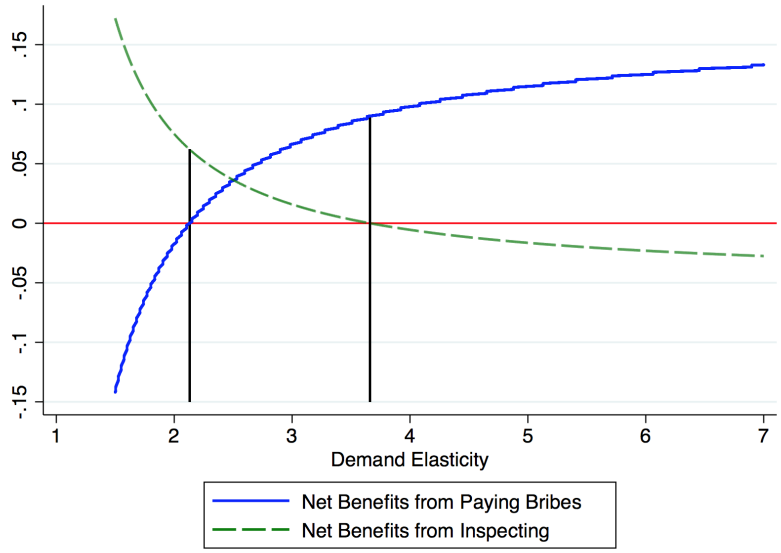
$$b' = \underset{b}{\operatorname{argmax}} \; w + \int_R b \left[\left(\frac{r}{r-1} \frac{c}{1-b} \right)^{1-r} + s(1-b)^r \right] dr - (s+\delta)|R| \tag{3}$$

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.

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

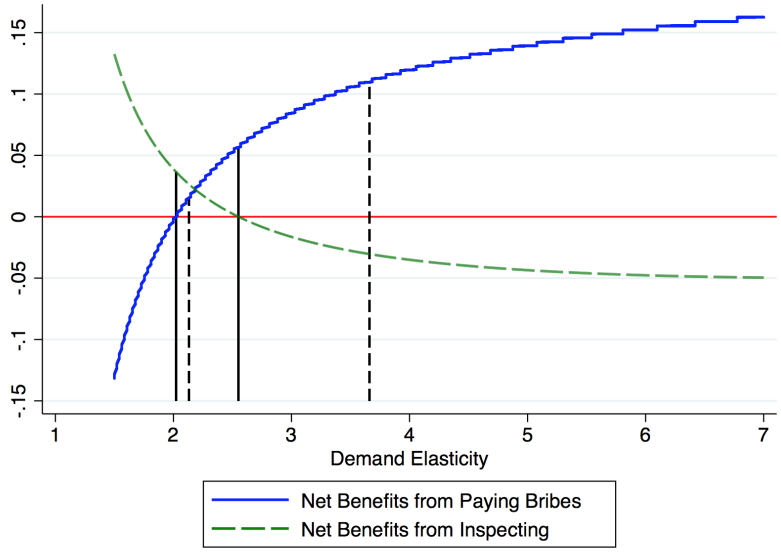
Notice that, upon revealing the presence of feedback incentives, the inspector no longer bears the full trade-off between bribes and evaluation. Indeed, we have that $b' > b''$. Nonetheless, it can be shown that the equilibrium payoff for the inspector is higher in the second case. The inspector is therefore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

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



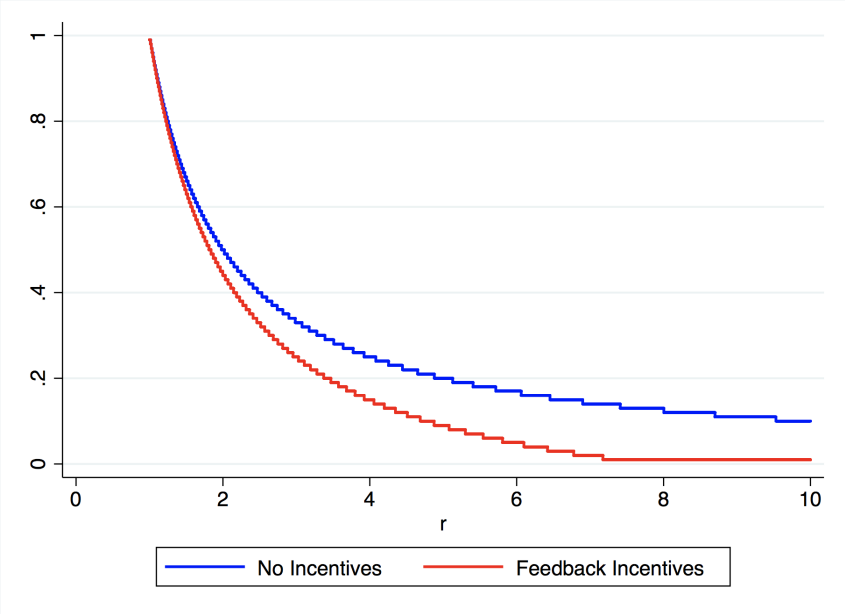
Notes. The figure illustrates the model equilibrium in the absence of feedback incentives in a model where inspectors choose the optimal bribe rate optimally depending on the elasticity of demand faced by the firm. The vertical continuous lines delimit equilibrium set of inspected firms.

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 the two cases without and with feedback incentives.