1 Introduction

Regulatory transparency is key in improving state capacity and foster economic development. In the case of tax collection activities, the lack of regulatory transparency negatively affects tax revenue mobilization efforts of governments (Besley and Persson 2014). It also dampens private sector development, as it increases the costs for private businesses of complying with tax legislation and dealing with the tax authority. Evidence suggests that these costs are disproportionally more relevant for Micro and Small Enterprises (MSEs) (IFC 2014). Given the structure of bureaucracy and the logistics of tax collection activities in developing countries, it is not uncommon for MSEs to reach informal agreements and engage in a bribing relationship with tax officials. The percentage of firms reporting to expect to give gifts or informal payments in meetings with tax officials ranges from 21.2% in Middle East and North Africa to 13.3% in Eastern Europe and Central Asia, as opposed to only 0.8% in OECD high income countries (World Bank 2015). Bribes may raise the marginal tax rate of firms, with a distortionary negative impact on investment, productivity and growth of MSEs (Olken and Pande 2012). This projects aims to improve the regulatory transparency of tax collection in the Kyrgyz Republic (KR). The KR stands out as one of the countries where the issues outlined above are particularly salient. According to World Bank (2015), 54.8% of surveyed firms expect to give gifts or informal payments in meetings with tax officials. The possibility of such informal arrangements is also recognized to be among the main factors which enable firms to decrease the taxable base, thus decreasing tax revenues for the government of the KR (IFC 2014).

We conceptualize bribes as the equilibrium outcome of an asymmetric information en-
vironment where the action of tax inspectors is unobserved to their principal. Tax inspectors may exert effort to extort bribes from MSEs, who may be willing to pay the bribe to avoid the cost of formal taxes. A misalignment of incentives arise between the tax service headquarters (the principal) and tax inspectors (the agent). In this setting, monetary incentives can increase the bargaining power of MSEs in their relationship with tax inspectors, and decrease the willingness of tax inspectors to engage in bribing activities. As a result, the equilibrium amount of bribes decreases, solving for the misalignment of incentives between the tax service headquarters and business tax inspectors.

In collaboration with the World Bank and the State Tax Service (STS) of the KR, we designed a monetary incentive scheme which pays a bonus to tax inspectors whose size depends on the reported level of satisfaction of MSEs in their relationship with tax officials. The form and size of monetary incentives which implements the first-best level of effort of tax inspectors is unknown ex ante, as it crucially depends on the unobserved parameters of our conceptual framework. We therefore designed four different incentives schemes. In two of them, local tax offices compete among themselves to win a single prize. The prize is awarded and split equally among all inspectors in the office which registered the highest percentage improvement in MSE’s customer satisfaction. The size of the final prize varies across the two groups, thus varying the power of incentives. We label these first two schemes as High Tournament (HT) and Low Tournament (LT), with the prize being higher for the HT scheme. In the other two cases, local offices do not compete among themselves. The bonus is calculated as a piece-rate which rewards them proportionally based on the office percentage improvement in MSE customer satisfaction. As before, we make the size of the piece-rate parameter different across the two schemes, thus having a High Piece-rate (HP) and Low Piece-rate (LP) scheme.

We evaluated the effectiveness of each proposed scheme by means of a 2x2 Randomized Controlled Trial (RCT). We allocated 50 local tax offices in the KR either to one of the four treatment groups as defined by the interventions specified above, or to a control group. Importantly, we let the size of incentives be such that the maximum total amount of bonus to be paid is equal across the HT and HP scheme, and across the LT and LP scheme. This allows us to answer the following question: given the budget constraint, which monetary incentive scheme is more effective in raising MSE customer satisfaction and tax revenues? Our study contributes to several strands of the literature. First, we design and evaluate the effectiveness of specific policies aimed to lower the extent of bribing, harassment and corruption involving tax officials in developing countries (Khan, Khwaja, and Olken 2016). To the best of our knowledge, ours would be the first study to specifically target business tax collection, and to theoretically explore these issues within a principal-agent framework. Existing studies in the literature use observational data to study the impact of bribes and corruption on firm activity and marginal costs.
(Fisman and Svensson 2007; Olken and Barron 2009; Sequeira and Djankov 2014). We produce experimental evidence on the effect of our interventions in reducing the extent of corruption and improving business outcomes. In doing this, we are also able to investigate whether the marginal tax rates faced by firms in the presence of corruption is more or less distortionary of their activity than it would be otherwise, and study how the salience of these distortions changes with market structure (Olken and Pande 2012). Finally, in analyzing the effect of our interventions on tax revenues, we also contribute to the literature on revenue mobilization and state capacity (Besley and Persson 2014).

2 The Setting

Tax collection and administration in the KR is managed by the State Tax Service (STS). The tax system in the KR is such that four different tax regimes exist, with a given business belonging to one or more of these categories: (i) VAT payers, (ii) Single tax payers, (iii) Patent holders, and (iv) Contract holders.

Business exceeding 4 million SOM (1 SOM ≈ 0.015 USD) of turnover are mandated to register as VAT payers. VAT payment is not mandatory for those business which are below the threshold. These business normally pay a number of different taxes: sales tax, income tax, etc. 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 Patent 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 business who qualify for the simplified regime can opt to be Patent holder. On top of the requirements to enter the Simplified tax regime (i.e., being below the VAT threshold and being individual entrepreneurs), business applying for being patent holder need to fulfill additional requirements related to sector of activity, turnover, and physical space (in squared feet) of business space. The patent holder purchases its patent, which can last one month or one quarter. The patent gives the holder the right to carry out a specific economic activity during the period for which the patent is valid. The patent cost is the only transfer the business makes to the tax authority. Separated from these categories is the regime for Contract holders. Business 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 of activity. The STS operates at the local level through 59 to 64 local tax offices. Local tax officers are also responsible for tax inspections. There exist two types of inspections: the visiting inspection and the raid inspection. The visiting inspection is carried out by a team of officers and can last several days, during which the team goes through the accounting books of the company. The business target for visiting
inspection are selected according to an automated algorithm which combines several
criteria, one of them being VAT liquidation. Hence, VAT payers are the most affected by
visiting inspections. On the contrary, *raid inspections* are typically performed by a single
officer. The officer has the discretionary power of deciding whether and when to visit a
given business. The raid inspector typically checks whether the business has the patents
to carry out a given activity, and rarely goes through the accounting books. The same
inspector typically visits the same business. According to STS data, raid inspections
target disproportionally more individual entrepreneurs rather then companies. The same
data reveal that the vast majority of registered individual entrepreneurs belong to the
category of patent holders. STS seems to be incentivizing business to enter this category
whenever applicable, especially when operating in organized marketplaces.

We expect both the sustainability of informal agreements with tax officials and the
incidence of harassment and bribing to be higher for individual entrepreneurs. First,
these are smaller in size and are likely to have low bargaining power when dealing with
tax officials. Second, they are disproportionately subject to raid inspections, where the
same single tax official has discretionary power in choosing target, and repeatedly visits
the same business. Therefore, we decided to focus on raid inspections by excluding VAT
payers from our analysis.

### 3 Conceptual Framework

The rationale for the proposed incentive schemes can be explained by means of a simple
conceptual framework. We analyze the misalignment of incentives between the central
tax administration and business tax inspectors in a principal-agent framework with
hidden action. To this end, we build upon Lazear and Rosen (1981) and extend their
framework in order to capture the features of the specific setting under investigation.

Consider a set of $n$ tax inspectors and $m$ firms inspected by each of these inspectors.
Tax inspectors exert effort $e_i \geq 0$ to extort bribes, which results in a bribe equal to $b_i$.
Effort maps into bribes with noise, meaning $b_i = e_i + \varepsilon_i$ with $\varepsilon_i \sim N(0, \sigma^2)$.

The central tax administration is interested in maximizing tax revenues $\tau_i$ from each
inspector net of his compensation $w_i$. The objective is also to minimize the total amount
of bribes $mb_i$ being paid to each inspector. The objective function of the central tax
administration (the principal) is

$$u_P = \sum_i \{\tau_i - \omega_i - mb_i\}$$

Each tax inspector earns his compensation $w_i$, plus additional earnings from bribes $mb_i$. 
Effort is costly for each agent, as captured by a quadratic and convex cost of effort function. The utility of a tax inspector (the agent) exerting effort \( e_i \) is thus equal to

\[
u_i = w_i + mb_i - \theta \frac{e_i^2}{2}\]

where \( \theta \) is an effort cost parameter equal for all \( i \).

As for the inspected business, let their payoff \( \pi_i \) depend on their revenues \( \Delta \) and the transfers to the inspector, in the form of share of taxes \( \tau_i/m \) or bribe \( b_i \), meaning

\[
\pi_i = \Delta - \frac{\tau_i}{m} - b_i - \gamma \cdot 1\{b_i \geq 0\}
\]

When entering the bribing relationship, the business faces the possibility of punishment to which it corresponds a cost equal to \( \gamma \). The punishment is equal to zero if \( b_i = 0 \).

The business also submits an evaluation of the job of the tax inspector. We assume this to be an increasing function of the business’ payoff. For simplicity, let the evaluation be equal to the payoff \( \pi_i \) itself.

The contract between the principal and the agent needs to satisfy a number of constraints. First, it needs to satisfy the incentive compatibility constraint and the participation constraint for the agent. Second, we assume that the contract also needs to satisfy a tax revenue constraint, which mandates revenues not to fall below a given threshold \( \bar{\tau} \). Finally, at equilibrium we also want the business not to be willing to enter the bribing relationship rather than paying the business tax, so that we also have a no-bribe constraint for the inspected business. Let the agent’s reservation utility is equal to \( \bar{u} \). The problem of the principal is therefore

\[
\max \sum \{\tau_i - w_i - mb_i\}
\]

subject to

\[
e_i = \arg\max_{e_i} w_i + mb_i - \theta \frac{e_i^2}{2}
\]

\[
w_i + mb_i - \theta \frac{e_i^2}{2} \geq \bar{u}
\]

\[
\tau_i \geq \bar{\tau}
\]

\[
\Delta - \frac{\tau_i}{m} \geq \Delta - b_i - \gamma
\]

It’s easy to show that, if the inspector is paid a fixed wage \( w_i = \bar{w} \), at equilibrium he exerts a positive level of bribing effort \( e^* = m/\theta \).

Consider now the case of a piece-rate incentive scheme which pays the inspector pro-
portionally to the evaluations submitted by the inspected business, i.e.

\[ w_i = t + s \, m \pi_i \]

From the incentive compatibility and participation constraint, and setting the tax revenue constraint to binding, we get

\[ e_i = \frac{m(1-s)}{\theta} \]

\[ t = \bar{u} - sm\Delta + s\bar{r} - \frac{m^2(1-s)^2}{2\theta} \]

so that the principal’s problem reduces to

\[ \max_s \bar{r} - \bar{u} + \frac{m^2(1-s)^2}{2\theta} + \frac{m^2s(1-s)}{\theta} - \frac{m^2(1-s)}{\theta} \]

subject to the no bribe constraint

\[ \Delta - \frac{\tau}{m} \geq \Delta - b_i - \gamma \]

Ignoring the constraint yields \( s^* = 1 \) and therefore \( e^* = 0 \) and \( b^* = 0 \). The no bribe constraint will be satisfied as long as a sufficiently high level of punishment \( \gamma \) for not paying taxes is enforced, meaning\

\[ \gamma \geq \frac{\tau}{m} \]

Finally, consider the case of tournament among tax inspectors. The latter are paid a fixed wage \( t \), plus they compete for a prize \( W \). The prize is awarded to the agent with the highest evaluation. The agent’s utility is thus equal to

\[ t + p_i W + mb_i - \theta \frac{e_i^2}{2} \]

where \( p_i \) is the probability for agent \( i \) of winning the tournament. The problem of the principal becomes

\[ \max \sum_i \{ \tau_i - t - p_i W - mb_i \} \]

subject to

\[ e_i = \arg\max_{e_i} \quad t + p_i W + mb_i - \theta \frac{e_i^2}{2} \]

\[ t + p_i W + mb_i - \theta \frac{e_i^2}{2} \geq \bar{u} \]

\[ \tau_i \geq \bar{r} \]

\[ \Delta - \frac{\tau_i}{m} \geq \Delta - b_i - \gamma \]
The probability of winning the tournament is given by

\[ p_i = \prod_{j \neq i} Pr(\pi_i > \pi_j) = \prod_{j \neq i} Pr(b_i < b_j) = \prod_{j \neq i} Pr(e_i + \varepsilon_i < e_j + \varepsilon_j) = \prod_{j \neq i} G(e_j - e_i) \]

where \( x = \varepsilon_i - \varepsilon_j \) is a newly defined random variable, and \( G(x) \) is its cumulative distribution function.

The incentive compatibility constraint becomes

\[
\max_{e_i} t + W \prod_{j \neq i} G(e_j - e_i) + m(e_i + \varepsilon_i) - \theta \frac{e_i^2}{2}
\]

All agents are identical at equilibrium they all exert the same level of effort. From the solution to this problem we get

\[ W = \frac{m - \theta e}{(n - 1)G^{n-2}(0)g(0)} \]

while setting the participation and the tax revenue constraint to binding we get

\[ t = \bar{u} + \theta \frac{e^2}{2} - \frac{m - \theta e}{(n - 1)G^{n-2}(0)g(0)} G^{n-1}(0) - me \]

so that the principal’s problem reduces to

\[
\max_{e} n \bar{\tau} - n\bar{u} - n\theta \frac{e^2}{2} + \frac{m - \theta e}{(n - 1)G^{n-2}(0)g(0)} G^{n-1}(0) + nme - n \frac{m - \theta e}{(n - 1)G^{n-2}(0)g(0)} G^{n-1}(0) - nme
\]

which yields

\[ e^* = 0 \]

while the optimal prize value is given by

\[ W^* = \frac{m}{(n - 1)G^{n-2}(0)g(0)} \]

As before, the no bribe constraint will be satisfied as long as a sufficiently high level of punishment \( \gamma \) for not paying taxes is enforced, meaning

\[ \gamma \geq \frac{\bar{\tau}}{m} \]

Our modified framework replicates the equivalence result in Lazear and Rosen (1981). If both the principal and the agents are risk neutral, the optimal choice of piece-rate parameter and tournament prize implement the first-best level of bribing effort \( e^* = 0 \)
under the two incentive schemes. However, the optimal size of the piece-rate parameter and the size of tournament prize are a function of a number of unobserved exogenous parameters of the model, such as the cost of effort parameter $\theta$. We therefore implement four different incentive schemes, two piece-rate and two tournament schemes, with varying power of incentives to test for the effectiveness of these different schemes in raising MSE customer satisfaction, decrease the amount of bribes and increase tax revenues.

4 Baseline and Balance

Our sample of business is randomly drawn from an initial sample of 10,000 business (1,100 contract holders, 4,100 single tax payers, and 4,800 patent holders) provided by the STS. Such initial sample was drawn from the population of registered taxpayers, randomly stratified based on their tax category, turnover size, sector of activity, and local tax office group.

We also gathered information on each of the local tax office of STS. Our final sample of business counts 2,337 business distributed across 50 local tax office operating areas. We randomly assigned each of the 50 local tax offices in the KR to either one of the four treatment groups - High Tournament (HT), Low Tournament (LT), High Piece-rate (HP), and Low Piece-rate (LP) - or to a control group.

Table 1 shows the coefficient estimates from a regression of office-level characteristics over four dummies indicating the four treatment groups, using the local tax office as unit of observation. Table 2 shows instead the same coefficient estimates using business-level data and having business and inspection-related outcomes as dependent variables. Evidence shows that these baseline characteristics are balanced across the four treatment groups.

5 The Intervention

As mentioned earlier we divide KR STS offices in 5 different arms of 10 offices each:

1. Control Group: no communication is held with this group.

2. High Piece-rate: this group will receive a high payment for any improvement over the baseline score. The rate of payment $s = 1.95$. The formula for the final payment is the following:

$$ Bonus = 1.95USD \times \Delta \text{score} = 1.95USD \times \frac{(\text{Newscore - Baselinescore})}{(\text{Maxachievable score - Baselinescore})} \times 100 $$
3. *Low Piece-rate*: this group will receive a low payment for any improvement over the baseline score. The rate of payment $s = .66$. The formula for the final payment is the same as the one above with the lower $s$.

4. *Tournament High Prize*: this group will compete in a tournament with other 10 offices to receive a high prize of 900USD per inspector. The tournament is based on the improvement score:

$$\Delta \text{score} = (\text{Newscore} - \text{Baselinescore})/(\text{Maxachievable} - \text{Baselinescore}) \times 100$$

5. *Tournament Low Prize*: this group will compete in a tournament with other 10 offices to receive a high prize of 300USD per inspector.

It is important to mention here that the per capita GDP of KR is around 100USD per month so that our prizes are substantial. We have already collected the baseline information on the relevant observables in our baseline survey completed in April 2016. The treatment intervention consisted in making sure the relevant tax raid inspectors were precisely informed about the schemes. We achieved this by running a series of workshops where the inspectors were invited and participated at very high rate, the "invitation" was forwarded by the deputy head of STS. More than 70% of the inspectors showed up for the workshop, while we made sure to circulate instructions and letters for the scheme to all the absentees as well. We first gave the documentation to the head of the raid inspectors in the local office, and second by calling up those who did not show up for the information sessions. In reality the reasons for being absent are: vacation, illness, and needed in the local office.

This first round of incentives will run until June 30th, 2016, we will then collect the follow-up data and proceed with payments. While we plan for a second and third round of incentives.
<table>
<thead>
<tr>
<th></th>
<th>Log of No. of Inspectors</th>
<th>Log of No. of registered business</th>
<th>Probability of Raid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Piece-rate</td>
<td>-0.442</td>
<td>-0.262</td>
<td>-0.052</td>
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<td></td>
<td>(0.32)</td>
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<td>(0.39)</td>
<td>(0.78)</td>
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<td></td>
<td>(0.46)</td>
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<tr>
<td>Control Mean</td>
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<td>Observations</td>
<td>50</td>
<td>50</td>
<td>50</td>
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<tr>
<td>$R^2$</td>
<td>0.05</td>
<td>0.02</td>
<td>0.03</td>
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Notes. p-value in parenthesis.
Table 2: Firm-level Variables

<table>
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<tr>
<th></th>
<th>Log of Labor</th>
<th>Labor Missing</th>
<th>Log of Capital</th>
<th>Capital Missing</th>
<th>Log of Revenues</th>
<th>Revenues Missing</th>
<th>Log of Profits</th>
<th>Profits Missing</th>
<th>Revenues Per Worker</th>
<th>Capital Per Worker</th>
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<th>Female</th>
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<td>-0.042</td>
<td>0.004</td>
<td>0.235</td>
<td>-0.140</td>
<td>0.413</td>
<td>-0.127</td>
<td>0.151</td>
<td>-0.130</td>
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<td>(0.58)</td>
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<td>(0.44)</td>
<td>(0.24)</td>
<td>(0.50)</td>
<td>(0.34)</td>
<td>(0.86)</td>
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<tr>
<td>High Piece-rate</td>
<td>-0.048</td>
<td>-0.002</td>
<td>-0.194</td>
<td>-0.121</td>
<td>0.094</td>
<td>0.145**</td>
<td>0.064</td>
<td>0.123</td>
<td>0.122</td>
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<td>-0.110</td>
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<td>0.103</td>
<td>0.428</td>
<td>0.396</td>
<td>0.180**</td>
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<td>(0.38)</td>
<td>(0.36)</td>
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<td>(0.62)</td>
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<td>High Tournament</td>
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<td>-0.850*</td>
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<td>(0.62)</td>
<td>(0.02)</td>
<td>(0.68)</td>
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<td>(0.18)</td>
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<td>Control Mean</td>
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Notes. p-value in parenthesis. Estimates are conditional on variables used for sample stratification purposes: size, tax regime, STS office group, sector, and a dummy for Bishkek.

<table>
<thead>
<tr>
<th></th>
<th>Probability of Raid</th>
<th>Length of Inspection</th>
<th>Inspector Evaluation</th>
<th>Cost of Inspection</th>
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<td>Low Tournament</td>
<td>0.005</td>
<td>0.026</td>
<td>-0.359</td>
<td>90.305</td>
<td>-0.032</td>
<td>-0.008</td>
<td>-0.005</td>
<td>0.027</td>
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<td>(0.82)</td>
<td>(0.94)</td>
<td>(0.50)</td>
<td>(0.99)</td>
<td>(0.38)</td>
<td>(0.86)</td>
<td>(0.98)</td>
<td>(0.40)</td>
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<tr>
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<td>0.064</td>
<td>0.516</td>
<td>0.282</td>
<td>-357.222</td>
<td>-0.042</td>
<td>-0.019</td>
<td>0.046</td>
<td>0.008</td>
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<tr>
<td></td>
<td>(0.10)</td>
<td>(0.12)</td>
<td>(0.76)</td>
<td>(1.00)</td>
<td>(0.26)</td>
<td>(0.50)</td>
<td>(0.66)</td>
<td>(0.64)</td>
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<tr>
<td>Control Mean</td>
<td>0.092</td>
<td>4.465</td>
<td>6.532</td>
<td>524.350</td>
<td>0.067</td>
<td>0.050</td>
<td>0.094</td>
<td>0.080</td>
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<td>Observations</td>
<td>2,337</td>
<td>604</td>
<td>761</td>
<td>679</td>
<td>812</td>
<td>812</td>
<td>2,337</td>
<td>2,337</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.02</td>
<td>0.12</td>
<td>0.04</td>
<td>0.11</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.05</td>
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Notes. p-value in parenthesis. Estimates are conditional on variables used for sample stratification purposes: size, tax regime, STS office group, sector, and a dummy for Bishkek.
References


