

# Tax rate cuts and tax compliance – the Laffer curve revisited<sup>1</sup>

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**ABSTRACT:** The paper shows how tax rate cuts can increase revenues by improving tax compliance. The intuition is that tax evasion has externalities: tax evaders protect each other, because they tie down limited enforcement capacity. Thus, relatively small tax rate cuts, which decrease incentives to evade taxes, can lead to increased revenues through spillovers – creating Laffer effects. Interestingly, cutting de facto tax rates imply increasing de facto or effective tax rates. The model is consistent with the consequences of Russian tax reform, and may provide basis for further thinking about tax rate cuts in other countries.

**KEYWORDS:** tax evasion, tax compliance, Laffer curve

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## 1. Motivation

Can tax rate cuts increase revenues? The question has been recurring in tax policy discussions from the United States to other developed and emerging economies. The Russian flat tax experiment is particularly interesting: after the introduction of flat taxes, and cutting effective personal income tax rates, tax revenues increased substantially and almost immediately. Furthermore, they increased much faster than labor supply and output. That is cuts in de jure tax rates led to an increase in de facto effective tax rates. The paper explains how tax rate cuts can increase tax revenues through tax compliance spillovers in such a manner.

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Tax compliance issues are widespread and are of general interest. Even in the United States, with its sophisticated tax enforcement mechanisms, the IRS (2022) estimates the federal tax gap to reach US\$ 496 billion or around 15% of total revenues in 2014-16. Tax gaps and compliance problems might be even more relevant in emerging countries. This paper identifies the theoretical conditions under which tax rate cuts can increase compliance sufficiently to increase tax revenues.

To illustrate the potential effects of tax rate cuts on tax revenues consider the example of Russia. Russia introduced a flat 13 percent personal income tax rate during the 2001 tax reform, replacing the three tiered, 12, 20 and 30 percent previous rates (as detailed in Ivanova, Keen and Klemm, 2005). The tax exempt income was also increased, further decreasing the tax burden. Considering social tax reforms enacted at the same time, tax rates were cut substantially for most taxpayers. However, personal income tax revenues have increased significantly: 46 percent in nominal and 26 percent real terms during the next year. Furthermore, personal income tax revenues have increased from 2.4 percent to 2.9 percent of GDP — a more than 20 percent increase relative to GDP. Personal income tax revenues continued to increase to 3.3 percent during the next year, representing a further 14% gain relative to GDP. Consistently, official estimates also showed increased tax compliance.<sup>4</sup>

This paper shows that endogenous tax compliance responses can be responsible for the material increase in tax revenues. The key intuition is that tax regimes are prone to spillovers, as the aggregate behavior of taxpayers determines how much time the tax authority can dedicate to the individual taxpayer. In a way, tax evaders protect each other by tying down the tax authority's limited capacity. Hence, small cuts in the tax rates can lead to much larger changes in the behavior of taxpayers — most importantly, it can make them much more likely to declare their incomes correctly. These spillovers can lead to increasing tax revenues.

The paper builds a general equilibrium model with heterogeneous taxpayers with endogenous tax audit probabilities. The model is set up in three steps. First, we endogenize the probability of tax audits following Sah (1991) endogenous crime result. In the tax literature reviewed in Slemrod and Yitzhaki (2002) tax audit probabilities are taken exogenously. In our setup the tax authority has fixed time endowment to audit a unit volume of taxpayers. The fixed endowment incorporates the long term capacity building needs of increasing the tax authority's effective resources. Auditing honest taxpayers is less time consuming than auditing tax evaders, as there is no need for prosecution. Hence, the more taxpayers evade taxes, the less likely it is that

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4 On one hand, those affected by the tax rate cuts (higher income taxpayers) improved their compliance, which is consistent with our model. On the other hand, Ivanova, Keen and Klemm (2005) also found that the unaffected had significant salary increases and the observed compliance increase does not explain revenue increase. However, in the light of this model, it would worth further studies to disentangle effects of higher wages from those of higher reported wages and higher compliance. Higher reported wages might be a consequence of unobserved increase in compliance. In any case, this model is not an empirical evaluation of what has happened in Russia, but a general theoretical exploration of tax rate cuts.

the tax authority can audit individual taxpayers. In short, the tax authority's limited capacity combined with auditing time differences creates the externality.

Second, we endogenize labor supply decisions into the decision of the taxpayer. In order to obtain a closed form solution, a linear quadratic model setup is chosen.<sup>5</sup> Agents decide both about their labor supply and whether or not declare their income. Tax evaders who get caught pay due taxes and penalties proportional to the tax revenues evaded.<sup>6</sup> In this setup, taxpayers evade less tax payments when the tax rate is lower, *ceteris paribus*. Intuitively, the gains from tax evasion drop faster than potential costs as the tax rate decreases. The result is supported by Clotfelter (1983) who finds empirically that evasion increases with the tax rate.

Third, we introduce heterogeneous taxpayers, who differ in what we call shame, i.e. in their utility costs of punishment from public humiliation or prison sentences.<sup>7</sup> Sufficient taxpayer heterogeneity ensures that tax changes result in continuous changes in tax revenues.<sup>8</sup> Of course, "tax riots" (as in Bassetto and Phelan, 2006) can happen as responses to drastic measures, such as the British poll tax (see further in Besley et al, 1997). However, our focus is on the effects of minor changes in the tax rate through spillovers in compliance, without major changes in the perceived fairness of the tax regime ( see, for instance, Walsh, 2012).

The model demonstrates that even with relatively small labor supply responses tax rate cuts can increase equilibrium tax revenues significantly. The available data from the Russian flat tax experiment is consistent with the results detailed here. Gorodnichenko, Martinez-Vazquez and Sabirianova (2008) find that tax rate cuts have improved tax compliance during the 2001 Russian flat tax reform. According to Ivanova, Keen and Klemm (2005) the average effective personal income tax rate has increased from 11.2 percent to 11.8 percent suggesting higher compliance. Consistently, official estimates have shown an increase in compliance from 72.4 percent to 74.0 percent. The estimates of Ivanova, Keen and Klemm (2005) show an

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5 Risk neutrality implied by the model setup is not fully innocuous. As shown in Allingham and Sandmo (1972) risk averse consumers might in fact increase tax evasion under certain circumstances. Intuitively, lower taxes imply higher income, and thus higher propensity to gamble for risk averse consumers.

6 The literature (reviewed in Slemrod and Yitzhaki, 2002) distinguishes between two types of penalties: those proportional to tax revenues evaded and those proportional to income concealed. We choose the former as it is the weakest assumption we need: behavioral changes are, if anything, stronger if tax cuts do not also cut the punishment for evasion. Hence, our results are only stronger under the other assumption. The correct specification, however, might be relevant for calibrating the model, and it should be subject to further research.

7 The specifications leads to qualitatively equivalent results to the one under which costs of evasion differ.

8 The homogeneous taxpayer setup could potentially lead to multiple equilibria as in the reputational model of Cowell (1990). Even the heterogeneous agent model can produce multiple equilibria, as it is shown in the appendix.

even larger compliance effect for the affected group. Contradicting the traditional labor supply based explanations of the Laffer effect, measures of labor supply remained mostly unchanged.

Placing the tax evasion problem in a simple general equilibrium framework is useful for understanding the macroeconomic consequences of tax policy. First, it allows the joint investigation of taxes and other macroeconomic issues. Second, the joint setup allows future calibrations to separately analyze labor supply (i.e. classical supply side) and compliance related effects of tax cuts.

The model can be used to sharply distinguish tax compliance effects from labor supply ones when thinking about the effects of tax cuts on tax revenues. Classical empirical studies like Heckman (1983) or Feldstein (1995) abstract away from the compliance channel and focus entirely on the labor supply. Even the more recent Feldstein (2002) and the Fisman and Wei (2004) studies do not distinguish between the two effects when discussing the existence of the Laffer curve in alternative settings.

Finally, the model can be used to think about tax rate cuts and their effects. Most importantly, the tax compliance channel explored here provides a non-ideological tax rate cut rationale: tax rate cuts increase revenues by increasing the effective tax rate. This increase comes only at the expense of tax evaders, i.e. those who previously did not comply with the tax regime — and is not costly for law-abiding taxpayers. In fact, law abiding taxpayers' tax burden decreases while tax revenues increase. As a result policy makers might use the additional proceedings to cut taxes further or increase government spending at their discretion.

The paper is organized as follows. In the next section we set up the theoretical model in three steps. Second, we numerically explore the results and illustrate how tax cuts and tax enforcement measures work. Most importantly, we show that the Laffer curve can arise even with very small changes in labor supply effects.

## 2. Model

We investigate an economy populated by a unit volume of taxpayers. There is a single tax authority with limited resources, which audits taxpayers. The model is set up in three steps. First, we describe how tax enforcement works. Second, we introduce the maximization problem of the taxpayer, in particular the decisions on compliance and labor supply. Third, we introduce taxpayer heterogeneity and solve the model.

### Endogenous enforcement

Tax audits take time, and we assume that prosecuting tax evaders take more time than routine audits. Before auditing a taxpayer, the tax authority does not know whether she evaded taxes. A routine audit takes  $\tau_h$  time (“honest”), while auditing and prosecuting a tax evader takes  $\tau_e$  time (“evader”). We will assume that

$$\tau_e > \tau_h \quad (2.1)$$

i.e. that auditing and prosecuting tax evaders takes more time and effort than auditing honest taxpayers. The difference comes from many sources: preparing documentations for prosecution or trials, administering hearings, or undertaking prosecutions.

The total time endowment (“resources”) of the tax authority is , which we assume to be insufficient to audit the unit volume of honest taxpayers, i.e.  $\tau < \tau_h$ . In other words, the tax authority does not have enough time to audit all taxpayers, even if all of them are honest.

The timing is as follows:

1. Taxpayers select their strategy, which is not observed by the tax authority.
2. The tax authority audits taxpayers randomly until its time endowment is exhausted.

Using this setup, we define and derive two variables necessary to solve the model. Assuming that a fraction  $\lambda$  of the population evades taxes, let  $\mu$  denote the number of taxpayers the tax authority can audit before using up its time endowment. Then necessarily:

$$\mu = \frac{\tau}{\lambda\tau_e + (1 - \lambda)\tau_h} \quad (2.2)$$

Note that  $0 < \mu < 1$ , because  $\tau < \tau_h < \tau_e$ .

Since the total mass of taxpayers is unity,  $\mu$  is also the probability of being audited. Consequently, the probability that an individual taxpayer is audited is inversely related to the volume of tax evaders in the economy.

## Compliance and labor choice

Next we turn to the decision problem of the tax payers. Taxpayers maximize utility

$$u(c, \ell) = c - \frac{1}{2}A\ell^2 \quad (2.3)$$

where  $c$  is consumption and  $\ell$  is labor. Consumption is composed of (after-tax) income, where income is obtained using the linear production technology  $y = \ell$ .<sup>9</sup>

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9 To close the model, we could suppose that the government has to finance some fixed government expenditure , with budget constraint

$$\text{taxes} = g + \text{transfers} \quad (2.4)$$

where the transfers to the consumers would be lump-sum, leaving the first order conditions below unchanged. We omit this for brevity.

Taxpayers are required to pay a  $\gamma < 1/2$  fraction of their income  $y$  in taxes.<sup>10</sup> However, taxpayers will decide whether or not to pay the taxes. For tie breaking, we assume that indifferent taxpayers pay their taxes honestly:

$$u_e > u_c \quad (2.5)$$

Tax evaders do not pay taxes, but tax evasion requires a fixed effort (regardless of income level), which we denote by  $E$ .<sup>11</sup> Furthermore, we assume that if an agent is caught, she is required to pay taxes *plus* a punishment of  $\pi\phi$  times taxes  $\gamma y$ . In this framework,  $\pi$  is the “general” level of punishment for tax evasion, while  $\phi$ , which we interpret as the “shame” parameter, varies in the population: it is meant to capture the difference in the subjective utility weight that different taxpayers place on the same nominal punishment. For instance, some might perceive the humiliation of a prison sentence or a fine worse than others.<sup>12</sup> We will denote the cross-sectional distribution of  $\phi$  by  $F$ , and impose<sup>13</sup>

$$E[\phi] = 1 \quad (2.6)$$

If the taxpayer pays taxes,  $c = (1 - \gamma)y$ , and she solves

$$\max_{\ell} (1 - \gamma)\ell - \frac{1}{2}A\ell^2 \quad (2.7)$$

which yields

$$\frac{1 - \gamma}{A} = \ell \quad (2.8)$$

Thus, honest taxpayers receive utility

$$u_h = \frac{1}{2} \frac{(1 - \gamma)^2}{A} \quad (2.9)$$

If the taxpayer decides to evade taxes, she solves utility as

$$\max_{\ell} (1 - \mu)\ell + \mu(1 - \gamma(1 + \pi\phi))\ell - \frac{1}{2}A\ell^2 - E \quad (2.10)$$

when we use  $\mu$  as derived in Section 2.1, as the probability of an audit. From the first order condition and the requirement that  $\ell \geq 0$ ,

$$\ell = \max\left(0, \frac{1 - \mu\gamma(1 + \pi\phi)}{A}\right) \quad (2.11)$$

10 The linear quadratic functional form and the restriction on  $\gamma$  ensures that we do not have labor supply induced Laffer effects. Without compliance effects increasing taxes would increase tax revenues in this setup.

11 The auditing mechanism is as described in Section 2.1.

12 The results do not change if heterogeneity is displayed in the cost of tax evasion,  $E$ . This could be interpreted as differing access to tax evasion techniques.

13 If we did not impose a constraint on the mean of  $\phi$ , either that or would be redundant.

Similarly to (2.9), tax evaders can expect utility

$$u_e = \frac{1}{2} \frac{\max(0, (1 - \mu\gamma(1 + \pi\phi)))^2}{A} - E \quad (2.12)$$

Taking  $\mu$  as exogenous and using (2.5), the taxpayer will cheat if and only if

$$\frac{1}{2} \frac{\max(0, 1 - \mu\gamma(1 + \pi\phi))^2}{A} - E \geq \frac{1}{2} \frac{(1 - \gamma)^2}{A} \quad (2.13)$$

Solving condition (2.13) is simplified by noting the following. If the  $\max(0, \dots)$  term is zero, that implies that the labor supply of the tax evader is zero. This in turn implies that the left hand side of equation (2.13) is negative, while the right hand side is positive. In other words, condition (2.13) is not satisfied for sure when the  $\max(0, \dots)$  term is zero. Hence, we can focus on the case when the term is positive.

Condition (2.13) then holds if and only if

$$1 - \mu\gamma(1 + \phi\pi) \geq \sqrt{(1 - \gamma)^2 + 2AE} \quad (2.14)$$

which is equivalent to

$$\phi \leq \frac{1}{\pi} \left( \frac{1 - \sqrt{(1 - \gamma)^2 + 2AE}}{\mu\gamma} - 1 \right) \equiv \hat{\phi}(\mu, \gamma, \pi) \quad (2.15)$$

which gives unique condition in terms of  $\phi$ , when the taxpayer pays taxes as prescribed.

Before continuing to solve the model, it is worth to explore the comparative statics of the  $\hat{\phi}$  threshold. The threshold is the lower (i.e. less taxpayers evade), if the equilibrium probability of an audit is higher,  $\partial \hat{\phi} / \partial \mu < 0$ . Also, less taxpayers evade, if tax evasion is costlier,  $\partial \hat{\phi} / \partial E < 0$ , and if the objective punishment is higher,  $\partial \hat{\phi} / \partial \pi < 0$ . More interestingly, less taxpayers evade, if the disutility of work is higher  $\partial \hat{\phi} / \partial A < 0$ . The intuition is, that higher disutility decreases income, hence the gains from evasion. Finally, more taxpayers evade the higher the tax rate is as expected,  $\partial \hat{\phi} / \partial \gamma > 0$ .<sup>14</sup> Intuitively, the higher the taxes the more is to be gain from evading them.

## Equilibrium and comparative statics

Using the previous results, the total mass of agents evading taxes for a given  $\mu$  is

$$\kappa(\mu; \gamma, \pi) = F(\hat{\phi}(\mu, \gamma, \pi)) = F\left(\frac{1}{\pi} \left( \frac{1 - \sqrt{(1 - \gamma)^2 + 2AE}}{\mu\gamma} - 1 \right)\right) \quad (2.16)$$

It is easy to see that  $\kappa(\mu)$  is decreasing in  $\mu$  as expected.

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<sup>14</sup> The derivation is in Section 5.1.

We can also derive the total mass of tax evaders using the tax authority resource constraint equation (2.2), again as a function of  $\mu$

$$\hat{\lambda}(\mu) = \frac{\tau/\mu - \tau_h}{\tau_e - \tau_h} \quad (2.17)$$

In equilibrium these two measures of mass of tax evaders are the same, hence we define the equilibrium  $\mu$  such that

$$\lambda(\mu; \gamma, \pi) = \hat{\lambda}(\mu; \tau, \tau_h, \tau_e) \quad (2.18)$$

The right hand side converges to  $\infty$  when  $\mu \rightarrow 0$ , and when  $\mu \rightarrow 1$ , equals to

$$\frac{\overbrace{\tau - \tau_h}^0}{\tau_e - \tau_h} < 0 \quad (2.19)$$

Since both sides are decreasing in  $\mu$ , this curve may have multiple intersections. If  $\lambda$  is a continuous function of  $\mu$  (this holds if and only if the distribution  $F$  is continuous), the two curves have an *odd* number of intersections (at least one), since  $\lambda$  starts above (at  $\mu = 0$ ) but ends below (at  $\mu = 1$ ) the function  $\hat{\lambda}$ . For simplicity, we will consider the case when the two curves intersect only once, eliminating multiple equilibria (which are briefly explored in Section 5.2). This of course requires that at the point of intersection, the slope of the tax evaders curve ( $\lambda$ ) is smaller than the slope of the audit capacity curve ( $\hat{\lambda}$ ) in absolute value.

Changes in parameters move the audit capacity and tax evaders curves, and the fact that each one of the parameters  $A, E, \pi, \gamma, \tau, \tau_h, \tau_e$  affect only one of these curves makes comparative statics easier. First we discuss the behavior of the  $\hat{\lambda}$  curve, which establishes the audit capacity required for a given audit probability. From (2.17), note that only the ratios  $\tau_h/\tau$  and  $\tau_e/\tau$  matter. Increasing  $\tau$  but leaving  $\tau_h$  and  $\tau_e$  constant moves this curve upwards, moving the intersection of the two curves to the right (higher audit probability) and downwards (fewer tax evaders). Increasing  $\tau_e$  or decreasing  $\tau_h$  (ceteris paribus) would of course have the opposite effect, making tax evasion harder to persecute in relative terms.

Second, using the comparative statics for  $\phi$  from the end of Section 2.2, we can also explore the changes in the  $\lambda$  curve (tax evaders as a function of audit probability), since  $F$  is a strictly monotone increasing function,  $\lambda(\dots) = F(\phi(\dots))$  inherits the properties of the comparative statics. For example, increasing the tax rate  $\gamma$  moves the  $\lambda$  curve upwards, leading to more tax evaders and lower audit probability. Increasing  $A, E$  or  $\pi$  moves the curve downwards, resulting in fewer tax evaders and higher audit probability.

Qualitatively these features of the model are consistent with out intuition, but it remains to be seen whether the results are significant when we actually calculate equilibria, which we deal with in the next section.

### 3. Illustrative Example

The previous sections have solved the model in general parametric terms. In this section, we turn to parametrize the variables and use numerical techniques to illustrate the results. We undertook the analysis with the following parameter values:  $A = 1$ ,  $E = 0.1$ ,  $\gamma = 0.115$ ,  $\pi = 3$ ,  $\tau = 1$ ,  $\tau_h = 20$  and  $\tau_h = 50$ . The interpretation of the parameters is straightforward. For instance, we assumed that tax evaders' punishment amounts to three times the evaded taxes, and if everyone was honest, the tax authority would be able to audit  $1/20 = 5\%$  of the population. The parameters have been chosen to be both realistic and demonstrate the revenue increasing effect to tax rate cuts.<sup>15</sup> Furthermore, we assumed that  $\phi$  is distributed lognormally such that the underlying normal distribution has unit variance.<sup>16</sup>

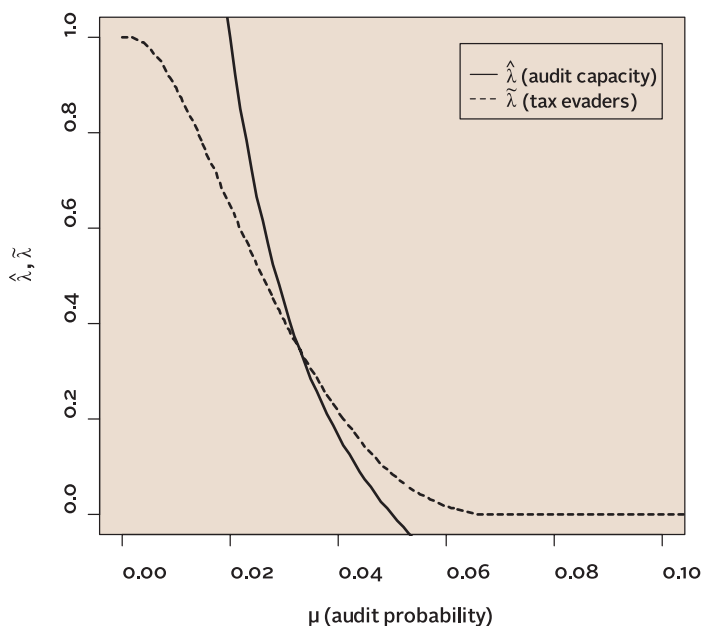
Figure (1) shows the equilibrium at the intersection of equations (2.17) and (2.18). As discussed in Section (2.3) the system always has at least one solution, and we concentrate on cases where this solution is unique (relegating the case of multiple equilibria to the appendix). In the equilibrium in Figure (1) somewhat less than 34.6% of taxpayers evade taxes and the likelihood of a tax authority audit is around 3.3%. The economy described on Figure (1) shows roughly twice as large tax gaps as the 16.3% IRS (2006) estimate for the United State. Thus, our example shows a country with significant, but far from unrealistic tax compliance problems.

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15 Of course, the parameters could certainly be further calibrated to fit a particular country case or legal setup. However, these parameters provide a good starting point for analysis and the model's prediction do not depend on the parameter choice. In order to check robustness, we performed the calculation with variations in the parameter values, which left the main results intact.

16 (2.6) pins down the mean.

Figure 3.1: Equilibrium



The first question is what happens in equilibrium when the tax rate changes. Figure (2) highlights the response to moderate tax rate changes. The tax rate of the original equilibrium is 11.5%. We investigate what happens when the tax rate is changed by  $\pm 1\%$ , 11.615% and 11.385%. When the tax rate is increased by 1%, the  $\tilde{\lambda}(\mu)$  curve, which denotes the number of evaders, shifts to the right. The audit capacity curve  $\hat{\lambda}(\mu)$  as the resources of the tax authority are left unchanged, does not shift. In the new equilibrium, 8.9% of taxpayers evade taxes. In other words, a 1% tax rate cut results in a 40% increase in tax compliance. Similarly, if the tax rate is increased the  $\tilde{\lambda}(\mu)$  curve shifts to the left. In the new, higher tax equilibrium 51.3% of taxpayers evade taxes.

Figure 3.2: Tax rate change: 1%

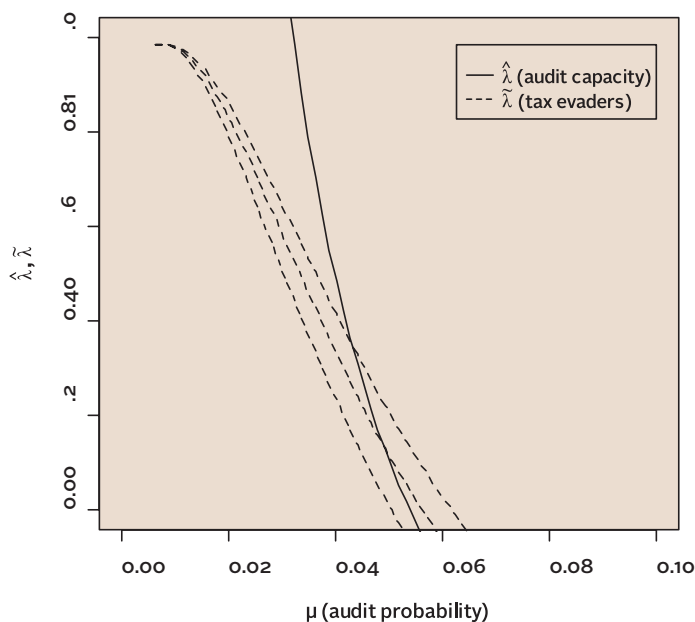


Figure (3) shows the case for much larger, 5% changes in the official tax rates, to and . This large change chart helps illustrating the strong non-linearities of the model. The large tax rate cut almost completely eliminates tax evasion. In fact, it is evident from a cursory look on the chart, that a much smaller rate cut could accomplish that. A large tax rate hike, however, would raise non-compliance to 77.4%, by almost doubling it. The strong differences between the two equilibria show the need for careful empirical investigations. Reactions to tax changes might look as strong as shifts between multiple equilibria, whereas they might be only the consequences of very strong spillovers and resulting non-linearities.

Figure 3.3: Tax rate change: 5%

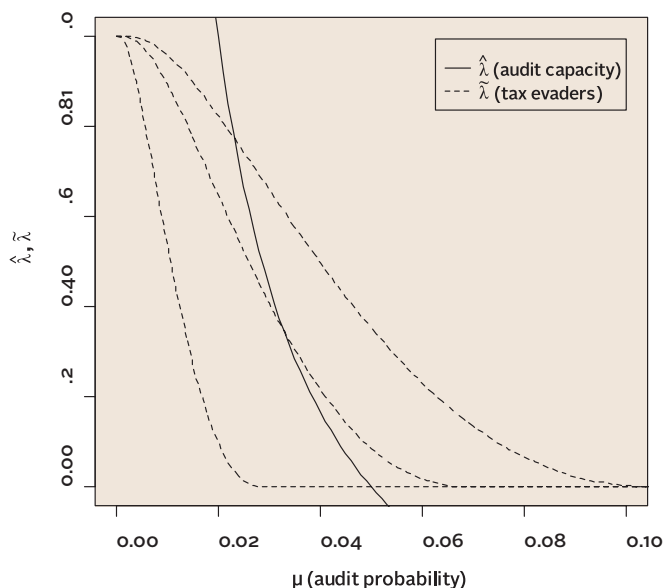
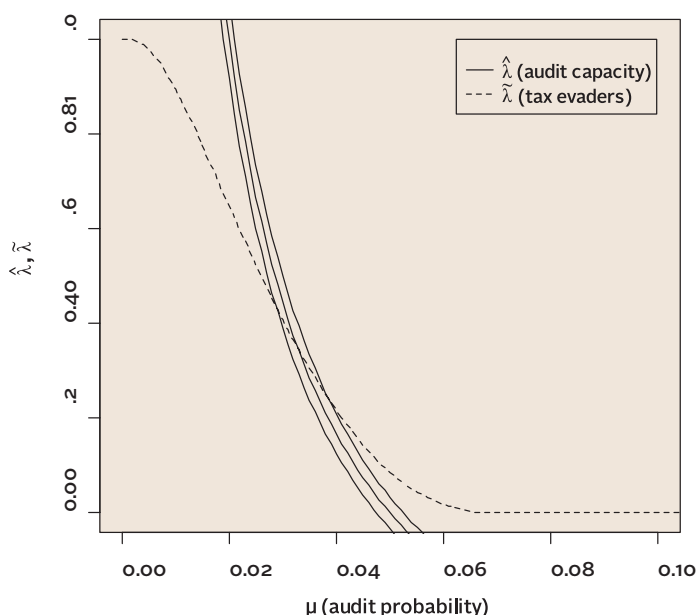


Figure (4) and (5) highlight how changes in tax enforcement affect tax compliance. Figure (4) shows the case when the tax authority's resource (remember  $\tau = 1$ ) is changes by 5%. If the tax authority's time endowment is increased by 5% (to 1.05), the audit capacity curve, the  $\hat{\lambda}(\mu)$  curve, shifts to the right. (Now, the tax evaders curve, the  $\tilde{\lambda}(\mu)$  curve does not move.) In the new equilibrium evasion is lowered to 23.9%, as expected. Weakening of the tax authority increases compliance through shifting the audit capacity curve to the left. In our example tax evasion rises to 43.6%. To see non-linearities, a 50% increase in the tax authority's time endowment (to 1.5) eliminates tax evasion completely. A 50% decrease in tax authority resource more than doubles non-compliance, and 87.7% of citizens evade taxes.

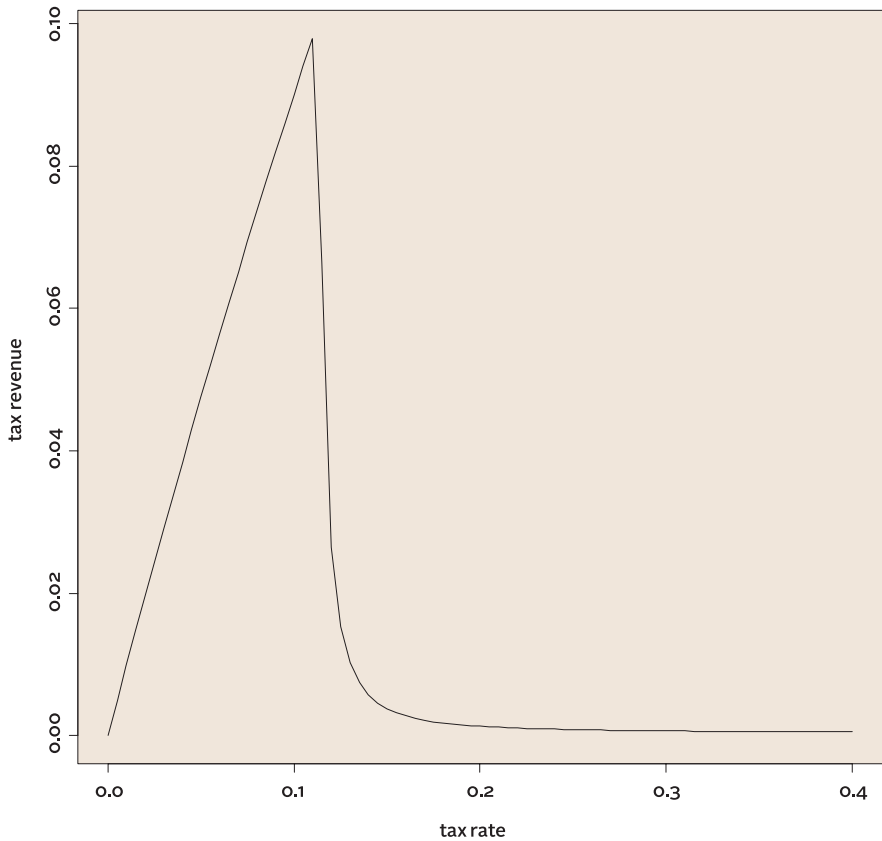
Changes in tax authority time endowment has very similar effects to tax rate cuts, though as the figures show, they work through different channels. Most importantly, the result highlights the potential trade-offs between improving tax enforcement and cutting official tax rates. Depending on the circumstance tax rate cuts might be preferred over strengthening enforcement. The necessary extensions to evaluate these trade-offs (and the welfare effects) are straightforward and omitted here.

**Figure 3.4: Changing tax authority time endowment ( $\tau$ ): 5%**



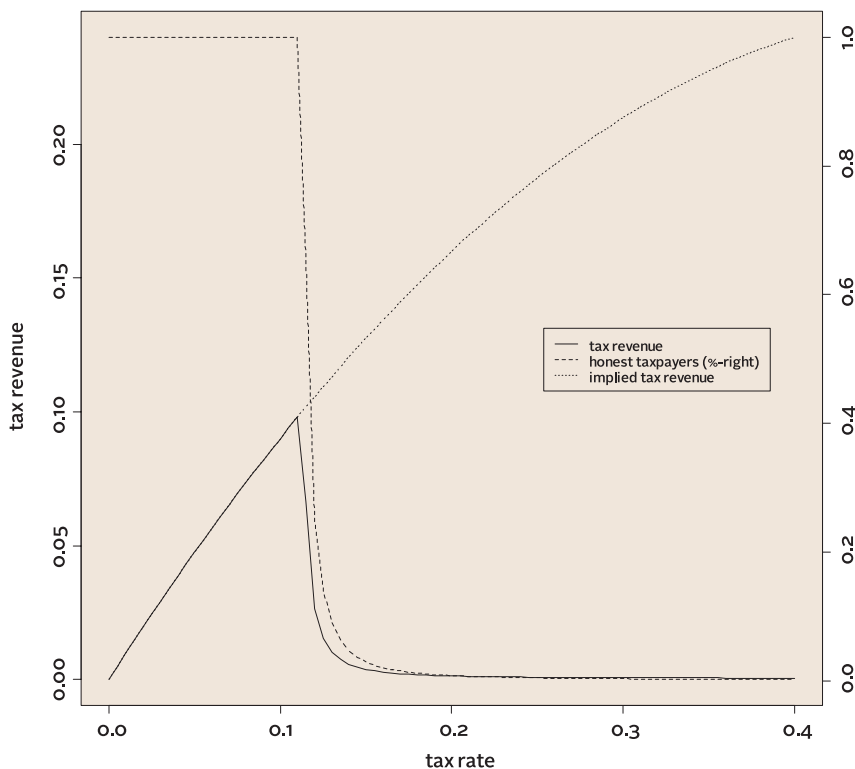
The most important question is, however, how tax rate cuts affect tax revenues. Figure (5) charts tax revenues as a function of the official tax rate. The chart depicts a Laffer curve: Tax rate increases initially increase tax revenues until the tax rate reaches 12%. The Laffer effect is coming from increased compliance and not from labor supply responses as Figure (7) shows.

Figure 3.5: Laffer curve



On Figure (6) we depict the changes in the implied tax revenues, which is the revenue that taxpayers would pay if they were all honest. As evident from the figure, the tax revenue is increasing when  $\gamma < 1/2$ . Hence, labor supply changes do not cause the Laffer effect. Rather changes in tax compliance drive the results: The percentage of honest taxpayers falls dramatically when the tax rate exceeds 12% (right scale).

**Figure 3.7: Laffer curve decomposition**



Finally, the Laffer curve also highlights that tax rate cuts in this framework do not amount to effective tax cuts. Effective tax rates, in fact, increase when the official tax rate is cut. This is exactly what causes the Laffer effect here. Moreover, tax rate cuts raise effective taxes only by making tax evaders pay more taxes. Honest taxpayers will end up paying less taxes, while the government's tax revenues increase.

## 4. Conclusion

The model shows that tax rate cuts can increase tax compliance so much that tax revenues increase in response. Tax rate cuts can affect tax revenues through two main channels: Affecting the tax base or affecting compliance with the tax rules. The first channel is much discussed in the framework of the classical supply side literature. This paper explores the second, much less understood compliance channel in a macroeconomic framework.

The model's findings are consistent with what the 2001 tax reform in Russia, for instance. This research has been motivated by the Russian experience, where tax rate

cuts have increased both tax revenues and effective tax rates. The fact that measures of compliance also have shown marked increase further hints at the appropriateness of the example. However, the aim of this paper is not to explain the Russian flat tax experiment, but to address a general economic point relevant much more widely. Evaluating the Russian tax cuts is clearly an empirical question with many other potential explanations.<sup>17</sup>

The theoretical model is potentially useful to think about tax policy. Most importantly, it identifies when this compliance based Laffer effect can arise, i.e. when tax rate cuts can increase revenues even on the short run. It is crucial to have medium strength tax authorities compared to the prevailing official tax rates. If tax authorities are relatively strong (at least relative to the prescribed taxes), then compliance is the best strategy for the overwhelming majority of taxpayers. Tax rate cuts or increases do not change compliance much, as audits ensure it. Similarly, if the tax authority is weak, no tax rate changes will induce compliance. With medium level tax authority strength, however, tax rates can have a pivotal role by incentivizing tax payers to declare their incomes correctly.

Furthermore, linking tax authority strength to official tax rates highlights the general applicability of the model. Three cases could be highlighted. First, countries with high official tax rates and relatively weaker tax authorities might benefit from tax rate cuts and improving compliance. Second, the model might be also relevant for countries with high tax rates, even if tax enforcement seems to be strong in absolute terms. Third, low tax countries which have particularly weak tax enforcement could also think about improving tax compliance via tax rate cuts.

The paper is also useful in highlighting trade-offs between improving tax enforcement (through more resources or higher punishments) versus improving tax compliance (through tax rate cuts). The model can be used for welfare analysis in comparing the different options. Extending the model and exploring the dynamic effects would be especially interesting. The optimal timing of compliance and enforcement measures might be complex. For instance, it could potentially be useful to rely initially on compliance effects while the tax enforcement capacity is built up.

The model can also be used to design future empirical studies. Empirical studies have mostly focused on the labor supply effect of tax rate cuts (i.e. on the tax base effects). The traditional literature reviewed in Heckman (1993) and the challenging study in Feldstein (1995) all focus on labor supply effects. Even more recent studies, such as Coenen et al (2007) or Trabandt and Uhlig (2006), continue to investigate the labor supply channel for potential Laffer curves. Following the logic of this paper,

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17 First, the tax reform coincided with the reform of tax collection. Obviously improved tax collection could also have increased tax revenues even with lower official tax rates. Second, according to official data the share of labor income has started to increase (and recover from the 1998 low point) around 2001. Hence, it might be that compliance effects were dominated by labor income increases. Third, income shifting from corporate to personal income could have also been responsible for the increasing tax base. These explanations are highlighted and discussed in detail in Ivanova, Keen and Klemm (2005).

compliance effects could be incorporated into empirical papers. In principle, studies like Fisman and Wei (2004) could directly identify the tax base (labor supply) and the compliance channel of the Laffer effect they find.

In conclusion, the paper developed an endogenous tax compliance model which explains how tax cuts can increase tax revenues without increasing labor supply much. Yet, this is only a first step: there is much left for future research. The most important step seems to be to expand the model to several periods and investigate the dynamic implications more closely. Most importantly, a finer distinction between short run and long run effects of labor supply and tax compliance would be highly useful for policy making. Further empirical research is needed to identify the exact conditions under which tax cuts can increase compliance sufficiently to increase tax revenues. Answering these questions would not only benefit our understanding of tax policies, but also help guide economic policy.

## 5. Appendix

### Comparative statics for $\phi$

First notice that under our assumptions  $\gamma < 1/2$ ,  $A, E > 0$

$$\gamma \leq \frac{1}{2} + AE \quad (5.1)$$

For making the algebra more transparent, let  $\psi$  denote  $\sqrt{(1-\gamma)^2 + 2AE}$ . Then

$$\frac{\partial \phi}{\partial \gamma} = \frac{1}{\pi} \frac{\partial}{\partial \gamma} \left( \frac{1 - \sqrt{(1-\gamma)^2 + 2AE}}{\gamma \mu} - 1 \right) = \frac{\frac{1-\gamma}{\psi} - \frac{1-\psi}{\gamma}}{\gamma \mu \pi} \quad (5.2)$$

We can rearrange the denominator as

$$\frac{1-\gamma}{\psi} - \frac{1-\psi}{\gamma} = \frac{\gamma - \gamma^2 - \psi + \psi^2}{\gamma \psi} = \frac{(\psi - \gamma)(\psi + \gamma - 1)}{\gamma \psi} \quad (5.3)$$

Now  $\psi + \gamma - 1 \geq 0$  is equivalent to

$$1 - \gamma \leq \sqrt{(1-\gamma)^2 + 2AE} \quad (5.4)$$

which always holds because  $A, E > 0$ .

As for the other term,  $\psi \geq \gamma$  is equivalent to

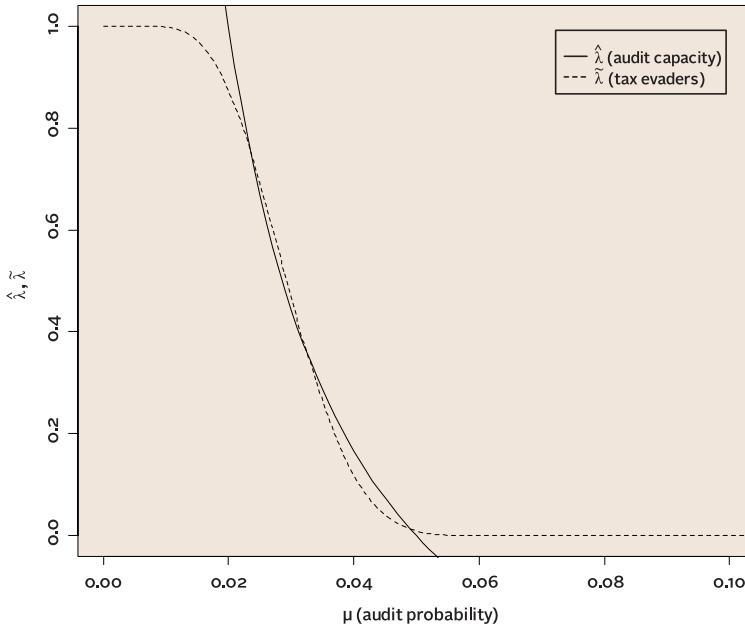
$$\begin{aligned}
 \sqrt{(1-\gamma)^2 + 2AE} &\geq \gamma \Leftrightarrow \\
 (1-\gamma)^2 + 2AE &\geq \gamma^2 \Leftrightarrow \\
 1 - 2\gamma + 2AE &\geq 0 \Leftrightarrow \\
 \frac{1}{2} + AE &\geq \gamma
 \end{aligned} \tag{5.5}$$

which is (5.1).

## Multiple equilibria

The model can produce multiple equilibria as it was discussed in Section 2.3. Here we only change the underlying normal distribution's variance to 0.5, and illustrate the results on Figure (8).

**Figure 5.1: Multiple equilibria**



Hence, the model is able to explain equilibrium switching patterns in theory. Intuitively, if agents are very similar, then marginal tax changes can lead to equilibrium switching. This simpler point is not pursued here in detail. However, an earlier version of this paper has explicitly derived how tax rate cuts can lead to equilibrium switching and increasing tax revenues and available upon request.

The figure also highlights that potentially perverse results can also arise depending on the relative slope of the audit capacity and tax evaders curves.

Comparative static exercises with parameter setup used in Figure ( 8) show that in the middle equilibrium increasing audit capacity would increase tax evasion. (This actually might also be seen without undertaking the formal exercise.) However, in the other two equilibria comparative statics are as expected.

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