Taxation and Evasion in the Presence of Extortion by Organized Crime

by

Michael Alexeev*

Eckhard Janeba**

and

Stefan Osborne***

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* Department of Economics, Indiana University, Bloomington
** University of Colorado at Boulder, NBER and CESifo
*** U.S. Department of Agriculture, Washington, DC

For correspondence please contact Michael Alexeev at Department of Economics, Wylie Hall, Indiana University, Bloomington, IN 47405; e-mail: malexeev@indiana.edu; fax: (812) 855-3736.

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Abstract

We model the taxation behavior of a revenue maximizing government in the presence of tax evasion by firms and the existence of a competing tax collector in the form of organized crime (the “mafia”). In order to evade taxes, the firm must shift some of its sales underground, possibly incurring costs. We show that the government’s optimal tax rate and revenue in equilibrium crucially depend on the importance of public goods or, equivalently, the efficiency of their production. When public goods are important, both the state’s tax rate and tax revenues are lower in the presence of the mafia than without it. However, when public goods are relatively unimportant, the government benefits from the fact that the mafia’s taxation imposes costs on the underground activities of the firms. The firms, on the other hand, are typically hurt by the mafia’s presence when public goods are not important and benefit from it otherwise. The joint payoffs of all players are higher with the mafia than without it if public goods are unimportant, but may become lower at the other extreme.

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1. Introduction

In countries where the state is relatively weak, alternative institutions may develop that usurp or supplement some important state functions. In particular, organized crime groups, which we will call the mafia, may be able to extort payments from firms, perhaps in return for providing protection from other criminals and a measure of property rights enforcement (see for example, Schelling (1984a,b) and Gambetta (1993) for particularly cogent description and analysis). While the relationship between firms and the mafia is usually quite complex, the payments that firms make can be viewed as a form of additional taxation of firms. Therefore, the presence of taxation by a mafia can be expected to affect the government’s tax policy. This paper examines the optimal tax policy of the state in an environment where the mafia competes with the state for extracting payments from firms.1 The paper’s model is particularly relevant to some of the economies in transition-- most notably, Russia--as well as to more traditional mafia strongholds such as Southern Italy.

The literature that examines the economics of the mafia and its influence on government’s policies emphasizes the mafia’s role as a provider of public goods such as property rights protection and contract enforcement that facilitate firms’ underground activities. (See for example, Grossman (1995) and in Johnson et al. (1997).) In this literature, the mafia, of course, does not provide public goods simply in order to enhance the firms’ welfare, but rather to induce them to move underground and to enhance the

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1 Throughout the paper, we refer to the producers as firms. However, the model can just as easily be interpreted in terms of individual laborers instead of firms.
mafia’s ability to collect payments from them.² The presence of the mafia as an alternative taxman and provider of public goods deprives the state of some of its tax revenue. Both in Grossman and in Johnson et al. the firm is better off and the state is worse off in the presence of the mafia than without it. Grossman, whose model is closest to ours, writes,

…competition between the mafia and the state reduces political rent, and it increases net total production to its technically feasible maximum… In addition, [this] competition … increases the net income of the representative producer. … the existence of the mafia harms only the members of the ruling class or political establishment whose main source of income is political rent. (p. 152)

Also, in Grossman’s model “the state both reduces its tax rate and increases its provision of state services, to meet [mafia’s] competition.” (p. 153) The only negative economic aspect of the mafia in this framework comes from its potentially disruptive effect on the state provision of public goods. These results have several implications. First, the state, particularly the kind that cares mostly about its revenues rather than the welfare of the producers, should be willing to spend significant resources on fighting the mafia that encroaches on its rents. Second, the economies with strong mafia presence are likely to have relatively low official tax rates. Third, these economies (including their unofficial sectors) should perform at least as well as the otherwise similar economies without the

² The public goods in this literature as well as in our model are not pure in the sense that the state can at least partially exclude underground firms from the use of its public good and the mafia can exclude above ground firms from the use of the mafia’s public good.
mafia. None of these implications seem to hold for countries (or areas) with the apparent large role of organized crime such as Southern Italy and Russia.\(^3\)

We argue that the results of Grossman and Johnson \textit{et al.} are driven by the crucial role of public goods in both models. In fact, in neither model, production is possible without some public good supplied by somebody. As our model demonstrates, if this assumption is dropped, strikingly different results may obtain. We parameterize public good provision by the state and mafia and show that when the public good is relatively unimportant for the firms or, equivalently, when the public good is very costly to produce, the presence of the mafia actually benefits revenue-maximizing state.\(^4\) However, as the importance of the public good rises, the state benefits less and less from the mafia’s presence, and eventually the mafia causes state revenues to decline. Thus, we are able to generalize the results of different models into a theory of taxation in the presence of the mafia.

The intuition for our result when public good is relatively unimportant can be best obtained in the extreme situation of no public good provision. In this case, the mafia’s presence unambiguously increases the firm’s costs of escaping from official taxation and thus benefits the revenue-maximizing state, because the latter is able to impose higher taxes. Meanwhile, the firms are worse off. This result is consistent with a widespread perception (at least until recently) of an excessively high tax burden in Russia and

\(^3\) Johnson et al. argue that high state tax and low mafia’s tax push firms underground. For this reason, the second implication would not hold in their model. Note, however, that Johnson et al. do not explain why the state would not lower its tax in response to the firms’ flight underground. In fact, they do not model either the state or the mafia as optimizing actors.

\(^4\) As we mentioned earlier, the main types of public goods we have in mind are property rights protection and contract enforcement. While the provision of these goods is important in every economy, in some countries the state or the mafia may have little, if any, relative advantage in providing these goods. For example, such public goods as state-produced contract enforcement may not be too important because, for example, firms have learned to operate without these public goods by relying on traditions, informal networks, or family ties.
Ukraine -- countries notorious for the large role of organized crime in their economies. For example, according to a World Economic Forum (1997) survey, the tax burden in Russia and Ukraine ranked as one of the heaviest of all countries examined. Egorova and Petrov (1996) found that the statutory tax burden on value added in Russia was larger than in 20 other countries, including developed nations and other economies in transition. In addition, survey results reported by Frye and Zhuravskaia (2000) also indicate that Russian shopkeepers rate taxes as their greatest problem.

When public goods are highly important for the firms, the mafia actually facilitates the escape of the firms from taxation by the state by providing public goods underground. Moreover, the mafia’s presence enhances competition in the provision of public goods and may increase their total output relative to the amount produced by the state as a monopolist. These considerations improve the firms’ welfare despite the tax that the mafia imposes on the underground activities.

However, competition in the provision of public good does not lead to a first-best outcome because a given amount of public good is most efficiently utilized when it can benefit all firms. Meanwhile, the state-produced public good benefits only those firms that are above ground and mafia produces the public good only for the underground firms. The exclusion of some of the firms from the use of some of the public good leads to socially costly duplication of public good provision. Due to this inefficiency, both social welfare and welfare of the firms could suffer in the case with the mafia, if in the mafia’s absence the state could make sure that almost all firms choose to stay above ground. In that case the government spreads the benefit of every unit of public good to a larger number of firms. This would indeed be the case when public goods are relatively
valuable to the firms.

The rest of the paper is organized as follows. The next section describes the model without the mafia. Section 3 introduces the mafia into the setup. The results of the two models are compared in Section 4. Section 5 concludes.

2. The Model without the Mafia

Consider a game with the state (or government) and a continuum of firms. The firms produce one unit of output that they sell at a price of one. The firms could operate either above ground or underground. The firm’s above ground sales are taxed by the government at rate $t$, $0 \leq t \leq 1$. The firm can evade the government’s tax by selling its output underground, but operating underground could be costly because underground operations have to be concealed, advertising may be difficult, etc. At the same time, in addition to avoiding taxation, firms may be able to reduce their costs by shifting production underground because they would not be subject to various government regulations such as accounting rules and environmental regulations. Disregarding taxation for a moment, different firms have different balance of costs of operating underground. We assume that the firms’ costs of operating underground are distributed uniformly in the interval $[-y, y]$ where $0 < y \leq 0.5$ is exogenous.\(^5\)

In addition to setting the tax rate, the state, which moves first, can provide the amount $u$ of a public good that enhances the firm’s payoff by $bu$, but does not in itself increase taxable output. (The latter assumption is not necessary for our results but makes

\(^5\)Our qualitative results do not depend on the assumption of symmetric support of the cost distribution and would have gone through even if we assumed that this support is $[-x, y]$ where $x, y > 0$. However, if $x$ were sufficiently small, part of Proposition 3 would not hold. The restriction $y \leq 0.5$ is introduced for technical convenience. If $y > 0.5$, some additional corner solutions may appear in the games examined below.
the analysis simpler.) The public good could represent the enforcement of property rights, so that the firm has to spend less to secure the profit from existing sales. Of course, in the longer run more secure property rights should lead to an increase in overall output, an aspect that we ignore here.

Formally, each firm’s payoff above ground is given by

\[(1 - t) + bu, \quad (1)\]

while its payoff underground is

\[1 - c, \quad (2)\]

where \(b \geq 0\) is a constant and \(c \sim U[-y,y]\). The firms decide whether to operate above ground or underground depending on the relationship between the respective payoffs.\(^6\) The threshold value of the firm’s costs for choosing to operate above ground, \(c_0\), can be obtained from equating (1) and (2). That is,

\[c_0 = t - bu. \quad (3)\]

so that the firms for which \(c \geq c_0\) are above ground, while the other firms operate underground. The state is assumed to maximize its tax revenues net of the cost of public goods. We assume that the state’s cost of producing public good is \(u^2\).\(^7\) This objective function could be interpreted as a traditional Leviathan. However, it is also possible to view the government’s goal as maximization of the funds available for redistribution.

Therefore, government’s payoff is

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\(^6\) Notice that given our assumptions about costless production and that \(t \leq 1\), the firms’ profits are always non-negative.

\(^7\) The assumption of decreasing returns to scale in the production of public goods is somewhat unconventional. An alternative specification would be to assume constant returns to scale in public goods production, but decreasing marginal returns in terms of payoffs of the firms. For example, the firms’ payoffs could be specified as \((1-t)-c+b \sqrt{u}\). This specification would not alter our qualitative results at all, but it would make the analytics considerably more cumbersome. Notice also that making both the firms’ payoffs and government’s costs linear in public good would eliminate interior solutions altogether.
\[(1 - F(c_0))t - u^2 \tag{4}\]

where \(F(c) = 0.5(c + y)/y\) is the c.d.f. of \(c\). Notice that we can reinterpret this setup by defining \(z = bu\). In this case, the last term in government’s payoff would become \(z^2/b^2\).

Then, \(b\) would parameterize the cost of producing public goods, with greater \(b\) corresponding to lower cost. The alternative interpretations of \(b\) are useful to relate our model to reality. However, in order to streamline the exposition of the model, we will hereafter interpret \(b\) as a measure of importance of the public good to the firms.

**Proposition 1.** Let \(b^2 < 8y\). Then,

(i) if \(b^2 < 6y\) the game without the mafia has a unique interior subgame perfect equilibrium. In this equilibrium, the state sets \(t^* = \frac{4y^2}{8y - b^2}\) and \(u^* = \frac{by}{8y - b^2}\), while the threshold cost is \(c^* = t^* - bu^*\);

(ii) if \(8y > b^2 \geq 6y\), the game without the mafia has a corner solution, where \(c^* = -y\), implying that all firms choose to operate above ground. In this case, if \(b^2 \leq 2(1+y)\), \(u^* = b/2\) and \(t^* = bu - y\). If \(b^2 > 2(1+y)\), \(t^* = 1\) and \(u^* = (1+y)/b\).

(The proof is straightforward.)

In the interior equilibrium (part (i) of the above proposition), the government’s payoff is

\[G^* = \frac{y^2}{8y - b^2} \tag{5}\]

and the threshold cost is

\[c^* = \frac{4y^2 - b^2 y}{8y - b^2} = \frac{y(4y - b^2)}{8y - b^2}. \tag{6}\]
Notice that the tax rate, the provision of public good, the government’s payoff, and the number of firms operating above ground increase in \( b \). Also note that when \( b^2 = 4y \), the sorting of firms between above ground and underground becomes efficient in the sense that the firms that would incur costs from operating above ground operate underground and the firms for which it would be costly to operate underground, operate above ground. At these parameter values, the net effect of government on the firms is zero, i.e., the cost of taxation, \( t = y \), is exactly offset by the benefit of the public good, \( bu = y \). (This is why the sorting of firms is efficient.) In addition, given the number of firms above ground, the government produces a socially optimal amount of the public good, \( u = y/b = b/4 \).

However, there is an inefficiency in this allocation because firms operating underground are deprived of the use of the public good. As will be seen later, this value of parameter \( b = 2y^{1/2} \) is critical for our economy with the mafia as well. Moreover, this value represents a threshold that determines the sign of the effect of the mafia on the government and on the economy in general.

### 3. The Model with the Mafia

We now modify the above model by introducing the mafia that taxes underground firms and provides them with \( bv \) amount of public good, where \( v \) is a choice variable of the mafia. Following Grossman (1995) and Johnson et al. (1997), we assume that the mafia can tax only underground firms.

The payoffs of firms operating above ground remain as in (1), but the underground payoff becomes

\[
8 \text{ Indeed, since the number of firms above ground is } \frac{1}{2}, \text{ the optimal amount of the public good can be found from maximizing } (1/2)bu - u^2, \text{ resulting in } u = b/4.\]
\[(1 - m) - c + bv, \quad (7)\]

resulting in the threshold cost of
\[c_0 = t - m - b(u - v). \quad (8)\]

The mafia’s payoff is given by
\[F(c_0) m - v^2. \quad (9)\]

In this game, we assume that first the state and the mafia choose their respective tax rates and public goods amounts simultaneously. The firms then decide whether to operate above ground or underground by comparing the payoffs \((1)\) and \((7)\).

**Proposition 2.** Let \(b^2 \leq 8y\). Then, the game with the mafia has a unique interior subgame perfect equilibrium with \(t^* = m^* = y, u^* = v^* = b/4\), and \(c^* = 0\). Moreover, no equilibrium in pure strategies exists in the game with the mafia if \(b^2 > 8y\).

**Proof.** The proof of the first part of the Proposition is straightforward. To prove the non-existence of the equilibrium in pure strategies for \(b^2 > 8y\), observe that the first order conditions for the government to be in the interior equilibrium \((0 < t < 1)\) require that:
\[
y - 2t + m - b(v - u) = 0
\]
\[
bt - 4yu = 0
\]
In addition, the participation constraint for the government implies:
\[
t[y - t + m - b(v - u)] - 2yu^2 \geq 0
\]
Combining these three inequalities yields \(b^2 \leq 8y\), which contradicts the premise of this part of the proposition. Similar argument holds for the mafia’s interior equilibrium. In order to exclude the possibility of a corner solution, we note that \(\partial G/\partial t\) evaluated at \(t=m=1\) is negative as long as \(y < 1\). Therefore, \(t=m=1\) cannot form an equilibrium. (Recall
that we are assuming that \( y \leq 0.5 \). Also, \( t=m=0 \) clearly cannot be an equilibrium either.

\textit{Q.E.D.}

\section*{4. Comparison of the Results}

This section addresses the effect of the mafia’s presence on the government and on the firms. In addition, we compare our results with those of Grossman (1995). In what follows, subscript “\([-m]\)” will denote the values in the model without the mafia, while the values in the game with the mafia will have no subscript. We will concentrate on the comparisons of the interior equilibria both with and without the mafia, i.e. the case of \( 0 < b^2 < 6y \). The case when all firms operate above ground in the absence of the mafia (\( 6y \leq b^2 \leq 8y \)) is obviously less relevant empirically. Moreover, the inclusion of that case would only strengthen our results.

Consider first the impact of the mafia on government’s payoff and tax rate:

\[
\Delta G = G^* - G_{-m}^* = \frac{1}{16} \frac{(12y - b^2)(4y - b^2)}{8y - b^2}
\]

(10)

\[
\Delta t = t^* - t_{-m}^* = \frac{y(4y - b^2)}{8y - b^2}
\]

(11)

Given the premise of our propositions, the denominator of (10) is always positive. Its numerator is positive if \( 4y > b^2 \) and non-positive otherwise. It can also be easily verified that \( \partial \Delta G / \partial b < 0 \). The same properties hold for \( \Delta t \).

It is also straightforward to demonstrate that the presence of the mafia results in greater aggregate provision of public goods. The difference between the economy-wide provision of public goods with and without the mafia is given by
\[ \Delta pub = u^* + v^* - u_m^* = \frac{b}{2} - \frac{by}{8y - b^2} = \frac{b(6y - b^2)}{2(8y - b^2)} \] (12)

Clearly, \( \Delta pub > 0 \) because by our assumption that \( b^2 < 6y \). Notice, however, that when the provision of public goods is split between the mafia and the state, each firm enjoys only \( b/4 \) amount of public good. It is perhaps more interesting to consider the difference between above ground supply of the public good with and without the mafia that is given by

\[ \Delta pub_{gov} = u^* - u_m^* = \frac{b}{4} - \frac{by}{8y - b^2} = \frac{b(4y - b^2)}{4(8y - b^2)} \] (13)

Therefore, it is quite possible that for large values of \( b \) (specifically, when \( b^2 > 4y \)) the firms operating above ground would benefit from a greater amount of the public good in the case without the mafia than with it.

These results are summarized in the following proposition.

**Proposition 3.** The presence of the mafia benefits the state and increases the above ground tax rate, \( t^* \), if and only if \( b^2 < 4y \). When \( 4y < b^2 < 6y \), the mafia’s presence leads to lower government’s tax rate and revenue. Moreover, for all feasible values of \( b \), \( \partial \Delta G/\partial b < 0 \) and \( \partial \Delta t/\partial b < 0 \). In addition, the mafia’s presence always increases the aggregate provision of public goods in the economy, but above ground firms enjoy more public goods due to the mafia’s presence only when \( b^2 < 4y \).

The impact of the mafia on social welfare defined as the combined payoffs of all players is somewhat more complicated. The combined payoffs are affected by the output

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9 When \( b^2 \geq 6y \), the corner solution for the case without the mafia involves \( u^* = b/2 \), i.e. the same as in the case with the mafia.
and cost of public goods produced by the state and the mafia as well as the distribution and range of the firms’ costs and benefits of operating underground. Welfare without the mafia is given by

\[ W_{-m}^* = (1 - F(c_{-m0}))(1 + bu_{-m}^*) + F(c_{-m0}) - ((c_{-m0})^2/4y - y/4) - (u_{-m}^*)^2 \]  \tag{14}

The first two terms in the above expression represent the output of all firms and the aggregate benefit of the public good. The third term shows the costs incurred by the firms from operating either above ground or underground.\(^{10}\) The last term reflects the cost of producing the public good. The tax income of the state is a transfer from the firms to the state and, therefore, need not be included in the welfare calculations.

In the equilibrium with the mafia, \(c_0 = 0\). Therefore, the welfare in this case is

\[ W^* = 0.5(1 + bu^*) + 0.5(1 + bv^*) + y/4 - (u^*)^2 - (v^*)^2. \]  \tag{15}

The difference, \(\Delta W = W^* - W_{-m}^*\), can be reduced to

\[ \Delta W = \frac{32y^3 + 40b^2y^2 - 14yb^4 + b^6}{8(8y - b^2)^2} \]  \tag{16}

The above expression is positive unless \(b^2\) is close to \(6y\). (Recall that interior equilibrium of the game without the mafia requires \(b^2 < 6y\).) The intuition for this result is as follows. The welfare advantage of the economy with the mafia is due to the fact that the firms allocate themselves socially efficiently between above and underground operations (the threshold value \(c_0 = 0\)). However, the economy with the mafia suffers a welfare disadvantage due to the duplication in the production of public goods. It is obviously socially suboptimal to produce public good separately for above ground and underground

\(^{10}\) The firms’ costs of operating underground are equal to \(\int_{-y}^{c_{-m0}} \frac{c_{-m0}}{(c/2y) - y} \, dc = \frac{c_{-m0}^2}{4y} - \frac{y}{4}\).
firms. Because of these considerations, as soon as more than half of all firms operate above ground in the case without the mafia, i.e., $b^2 > 4y$, the state is able to provide public goods more efficiently. The tradeoff between higher operating costs of the firms and greater efficiency of public good production by the state in the case without the mafia turns positive as $b^2$ gets close to $6y$.

If we consider only the welfare of the firms, the case with the mafia suffers an additional disadvantage in that the underground firms are subject to mafia’s taxation. At the same time, these firms have access to the public good produced by the mafia. When $b$ is small, the role of the mafia reduces largely to taxing firms without providing significant benefits in the form of public goods in return. Importantly, the mafia’s taxation of underground activities makes it possible for the state to increase its tax above ground, squeezing the firms at both ends. For this reason, the firms are worse off with the mafia than without it for small values of $b$.

As $b$ grows, the mafia’s provision of the public good becomes more important. Still, unless $b$ is relatively high, the firms in the aggregate are better off without the mafia, but the relative attractiveness of the case without the mafia declines as $b$ grows. For levels of $b$ close to $6y$, the tradeoff becomes more complicated and the firms’ payoffs with the mafia may exceed those without the mafia. This is because in the absence of the mafia, while the provision of the public good by the state increases, so do the state tax rate and the misallocation of the firms between above ground and underground operations. Figure 1 plots the difference between the aggregate welfare of the firms in the economies with and without the mafia as a function of $b$ when $y$ is set to 0.1.
It is much more straightforward to determine the effect of the mafia on the welfare of individual firms, depending on how the mafia’s presence affects the area of the firm’s activities. First, a firm that remains above ground both with and without the mafia is worse off due to the mafia’s presence as long as $b^2 \neq 4y$:

$$\Delta w_i = w_i - w_{i-m} = (bu^* - t^*) - (bu_{-m}^* - t_{-m}^*) = \frac{(b^2 - 4y)^2}{4(8y - b^2)} > 0$$

where $w_i$ denotes the payoff of an individual firm. A firm that is always underground either benefits from, or is hurt by the mafia’s presence depending on whether $b^2$ is greater than or less than $4y$, because this is determined simply by the sign of $bv^* - t^*$. It is also possible to show that a firm that shifts from underground to above ground when the mafia appears is always worse off because of the mafia, while if a firm goes in the opposite direction, it benefits from the appearance of the mafia.\(^{11}\)

4. Conclusions

Our model demonstrates that the effect of the mafia’s presence on the government policy and on the producers’ welfare crucially depends on the role of public goods in the economy or on the efficiency of their production, both of which are characterized by parameter $b$. For high values of $b$, our results are similar to those of Grossman (1995) where public goods are of utmost importance. In fact, in Grossman’s model, production by a representative firm is impossible without the public good although public goods

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\(^{11}\) To demonstrate the first case, notice that a firm that moves above ground when the mafia appears must have $c > 0$. For this firm to be underground in the absence of the mafia, it must also be true that $b^2 < 4y$ and that $c < t_{-m}^* - bu_{-m}^* = y(4y - b^2)/(8y - b^2)$. The firm’s payoff without the mafia is $1 - c$, while its payoff with the mafia is $1 + bu^* - t^* = 1 + (b^2 - 4y)/4 < 1 + y(b^2 - 4y)/(8y - b^2) < 1 - c$. By similar logic, it must be true in the second case that $c < 0$, $b^2 > 4y$, and $-c < bu_{-m}^* - t_{-m}^*$. The difference between the firm’s payoff with and without the mafia is $bv^* - m^* - c - bu_{-m}^* + t_{-m}^* > bv^* - m^* = (b^2 - 4y)/4 > 0$. 

supplied by the state could to some extent be used in underground production.\textsuperscript{12} In this case, the mafia’s presence hurts the state and lowers the official tax rate, while typically benefiting the firms.

Recall that we interpret our public goods primarily as property rights protection and contract enforcement. Grossman’s model may be appropriate for those economies where the state and the mafia are the only providers of these public goods. However, in those economies where producers can relatively easily rely on customs, personal connections, and family ties to enforce contracts, the role of the outside public good providers becomes relatively small. When this is the case, i.e., when $b$ is small, the state benefits from the mafia’s presence, because the mafia’s tax lets the state increase its own tax. At the same time, the firms are hurt by the tax that the mafia imposes on the underground activities.

Thus, our model provides a theory of the effect of the mafia on the state’s tax policy and public goods production. Our results can explain why in the countries where public goods are relatively unimportant or are costly to produce and their output is small, the revenue-maximizing state may not be particularly eager to fight organized crime. Our model also predicts that these economies would suffer from high official tax rates. Moreover, our model implies that in the countries characterized by efficient production of public goods, the state would have strong incentives to counteract organized crime and achieve a monopoly position as a public goods provider. This would result in higher welfare of the producers and smaller share of the underground economy than in the

\textsuperscript{12} We could easily include this feature in our model without changing the qualitative results. The analytics, however, would become unnecessarily complicated. Notice that in Grossman’s model, an underground firm had to be able to use the public good produced by the state. Otherwise, there would be no underground economic activities without the mafia. In our model, the firms could operate underground even without the public good.
former group of countries. The official taxes may be quite high in such economies, but so is public goods provision. These implications appear to be broadly consistent with casual observation. For example, Russia and Ukraine can be thought of as representative of the former group of countries, while the US and Western Europe belong to the latter group.
Figure 1. – The difference between payoffs of the firms with and without the mafia ($\Delta \Pi$) as a function of $b$ (parameter $y=0.1$).
References


