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Optimal Extortion and Political Risk Insurance ^{*}

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February 21, 2012

Abstract

We study the problem faced by firms that invest in a foreign country characterized by weak governance. Our focus is on extortion relying on the threat of expropriation and bureaucratic harassment. The bureaucrat's power is characterized by looking at a general extortion mechanism adapted from Myerson's (1981) optimal auction theory. This characterization is used to study the determinants of the quality of governance and whether and how political risk insurance of foreign direct investments improve upon it. We find that it does not always improve upon all governance indicators. It always decreases the bureaucrat's total revenue from corruption, but it may also increase the risk of expropriation and the extortion bribes paid by some firms.

KEYWORDS: Auctions; corruption; expropriation; extortion; governance; harassment; mechanism design; political constraints; political risk insurance.

1 Introduction

With the UK Bribery Act 2010, the issue of how to resist corruption has become vital for firms. The new regime has increased jurisdictional scope and has given rise to increased criminal exposure for corporate entities, particularly under the new strict liability corporate offence. In this context, some corporations complain that “passive bribery”, which covers the request for a bribe by public officials, is very little prosecuted. Basically, firms claim to be prosecuted when they actually are the victims of extortion. While this issue has recently become a major concern for Multi-National Corporations (MNC), it is also a major development issue since corruption negatively impact investment and growth (Mauro 1995). Governments in rich countries have long been aware of the larger risk their national firms were confronted with when investing in weak governance countries. In most developed countries public agencies have programs providing guarantees to protect the national firms' investments through political risk insurance as part of their development aid policy. Due to their respective national objectives those programs often have strict eligibility requirements. The World Bank's Mutual Investment Guarantee Agency (MIGA) aims at “complementing government-sponsored and private guarantee programs, . . . , to increase the flow of capital and technology to

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developing countries”.¹ The World Bank, as most international aid agencies, recognizes that weak governance is a major impediment to growth. A question of central interest is therefore: beyond its immediate impact through risk mitigation, do we expect political risk insurance to affect governance in the country hosting the investment?

This article deals with situations where the host government (we refer to it as the bureaucrat) demands bribes in exchange for refraining from expropriation, bureaucratic harassment, or for making a legitimate decision in the firm’s favor. Although extortion can be encountered in public tenders, the issue is particularly acute for firms that make direct investments in a foreign country. The physical presence with own assets on the territory of a weak governance country makes them vulnerable to (threats of) arbitrary treatment by the local authorities. A very powerful threat where the protection of property rights is weak is that of expropriation, the government can simply decide to steal the firm’s assets. More sophisticated can be the threat of bureaucratic harassment which can take the form of arbitrary changes in contract conditions or creating obstacles for the firm’s activity by various means (e.g., blocking access to electricity or water service, requesting numerous permits, delaying authorizations, ...). The risks related to extortion and bureaucratic harassment are part of what is called political risks.²

Econometric research about the links between political risk and foreign direct investment have produced mixed results (see World Bank Group 2009, Annex 5). When it comes to surveys of corporate officials, the message is unambiguous however. Businessmen report to be very concerned by political risk which they view as a major constraint when making their investment decisions. Among those risks two stand out: breach of contractual obligations by the state and expropriation actions (regulatory takings, creeping expropriation and outright nationalization) (MIGA 2011). In MIGA’s political risk survey 2009, nearly 45% of the respondents mention political risk as the greatest constraint on their business in emerging markets. When asked about the ways by which the firms attempt to mitigate the risks, nearly 70% respond “engagement with the government” in Russia, 65% in India and 55% in China.³

The expression “engagement with the government” is an euphemism for all kinds of influence and corrupt activities. The firms thus report being forced into corruption to mitigate some risks, in particular to avoid expropriation and bureaucratic harassment. Although it represents a serious concern for business and a challenge for development aid, the issue has received very little attention in the economic literature. Most often the knowledge and understanding about extortion remains at the level of anecdotes and case studies. This article proposes a general framework to better understand the mechanism at play when several firms are investing in a country where the bureaucrats have the power to expropriate some of them and can credibly threaten to do so in order

¹Preamble to MIGA’s convention. Beside national and multilateral providers of political risk insurances, there exists a smaller but developing private market.

²Political risk also includes risks due to war and terrorism.

³The proposed alternatives were joint-venture, risk analysis, and third party intermediation.

to extort bribes. We are interested in understanding what are the determinants of the quality of governance measured by the extent of expropriation, the magnitude of the extortion bribes, and the revenue from corruption. Within this framework we investigate whether and how the provision of political risk insurances can improve upon governance in the host country.

There exists as for today a large literature in economics about corruption.⁴ One can distinguish two perspectives on corruption both at the high and at the low level of government. The first perspective that has received most attention views the state as being captured by private interests. At the higher level it means that private interests shape laws and regulation in their favor at the expense of social economic efficiency. At the lower level, it implies that regulation is applied or abused to favor private interests in conflict with the objectives of the regulation. Corruption takes the form of mutually beneficial (illegal) agreements. A large literature based on the principal-agent model addresses capture (see, e.g., Tirole 1986, Laffont and Tirole 1993). Another strand of the literature addresses capture in auction (see for instance Compte et al. 2005, Burguet and Che 2005).

The other much less well-developed perspective views the state as controlled by a rent-seeker, i.e., a kleptocratic ruler who shapes laws and state institutions to maximize his own wealth by extracting rents from citizens and firms. Because it goes against the interests of most part of society, a natural question has been how can such a system survive (see, e.g., Acemoglu et al. 2004). Another set of questions that have been addressed relates to competition in rent-seeking between high and low levels government (Rose-Ackerman 1999, Shleifer 1993). Despite of the pervasiveness of bureaucratic harassment of firms and citizens to extract rents in most developing and transition economies with very significant economic consequences (see, e.g., Kligaard, 1988), there are few theoretical contributions in the microeconomics of extortion. One reason may be that extortion has long been perceived as a criminal endeavor performed by organized group. Konrad and Skaperdas (1997) address the issue of the credibility of the threat in racketing by criminal gangs. A few articles address extortion based on abuse of power. One example is Hindricks, Keen and Muthoo (1999) who study the optimal tax collection mechanism in a context where officials can threaten to over-report income to extort bribes. Choi and Thum (2004) study extortion of one firm when the bureaucrat who issued the license can come back and demand to renew the license in the second period. They show that there exists no pure strategy equilibrium of the repeated game, a feature that they interpret as a rationale for arbitrariness from the side of the bureaucracy. Lambert-Mogiliansky, Majumdar and Radner (2007) also address extortion in licensing but from a different perspective. They introduce the notion of track of bureaucrats, each of whom must give his approval in an ordered sequence. In each period a different firm needs a license to start business and faces the track. The article reveals a bureaucratic hold-up problem. In a one-shot setting no license is ever granted. In a repeated setting the article characterizes two interesting equilibria with licensing and different levels of extortion bribes and discusses the associated social economic cost

⁴See for instance Rose-Ackerman (2004, 2006, 2011) or Mishra (2005).

of extortion.

The issue of expropriation has been addressed by Thomas and Worrall (1994). They consider a bilateral relationship between a MNC and a host country. The host country can expropriate the MNC by force of its sovereignty. They study, in a multiple periods setting, the properties of a self-enforceable agreement where the firm gives transfer in exchange for being left to operate. A main result is under-investment and delayed payment in an initial period. This pattern obtains because of the MNC's concern to increase the cost of expropriation to the host country, i.e., the loss of future income. Our approach is very different. We do not model investment decisions; instead we consider several firms that are privately informed about the (exogenous) value of their investments in the host country, and we characterize the extortion power of the bureaucrat when he can expropriate and harass them. Our focus is on the quality of governance in the host country and on the impact of political risk insurance. The bureaucrat's power is limited by his imperfect of information about firms' profits in the host country. He may also have a political constraint, meaning that he may be able to expropriate only a limited number of firms. The bureaucrat aims at exploiting his power to extort maximal value. Our approach relies on Myerson (1981) to characterize the optimal extortion mechanism. The idea is that the situation shows strong similarities with an auction. The bureaucrat sells promises to "leave the firm alone" in exchange for a bribe. At first sight, the setting differs from Myerson (1981) in several respects. First, the bureaucrat can sell as many promises as he wants. Second, he may be forced to sell some of them by force of a political constraint (he may not expropriate as many firms as he wants). Third, the bureaucrat's valuation of the promises depends on the types of the firms that do not receive it, i.e., that are expropriated. Last, the firm's outside option may be type dependent. Nevertheless, we show that Myerson's technic is applicable. Our model covers very general situations, in which the value of expropriation and the cost of harassment for the bureaucrat could vary across firms, and firms may be heterogeneous with respect to their profit prospects and insurance coverages.

An optimal extortion mechanism is characterized by thresholds for non-expropriation and by the magnitude of the bribes the firms have to pay to avoid expropriation depending on other firms' bribe proposals. Our first result shows that the value or cost of expropriation for the bureaucrat is a determinant of the quality of governance. The higher the expropriation values the higher the reserve prices below which the bureaucrat wants to expropriate the firms and therefore the higher the risk of expropriation. When the political constraint is not binding all firms that are not expropriated pay a reserve price (which is common in case of ex-ante symmetric firms, and individualized otherwise). Hence, the higher the expropriation values, the higher the extortion bribes requested to avoid expropriation. Last, the revenue of the bureaucrat increases with the expropriation values both directly and indirectly through higher extortion bribes. Hence on all three accounts the values of expropriation negatively affect the quality of governance. The second determinant of the quality of governance is the political constraint. By definition the political constraint is a limit on the number of firms that can be expropriated and therefore on the risk

of expropriation. But we also show that it reduces the level of the extortion bribes requested to avoid being expropriated. When the political constraint is binding the bureaucrat is forced to sell promises not to expropriate at lower prices than the reserve prices. Finally, since this is a constraint on the bureaucrat optimization problem, the tighter it is (the less firms he can expropriate) the lower the bureaucrat's revenue.

In the second part of the article we introduce Political Risk Insurance (PRI). More precisely, we introduce a guarantee of compensation for firms incurring losses due to abuse of power, i.e., expropriation and bureaucratic harassment. In line with common practice, the compensation is calculated as a share of the investment.⁵ We first show how to introduce insurance into our model without altering the basic analytical tools. The optimal mechanism is defined for suitably modified variables, and it involves again threshold values or reserve prices which may be firm specific, and a rule to determine the magnitude of the bribe each firm has to pay to avoid expropriation. The central question is how does the level of insurance affects the outcome of the optimal extortion mechanism and the resulting quality of governance.

We first illustrate in a leading symmetric example with positive value for expropriation that introducing insurance has two effects. On the one hand it raises the overall risk for expropriation; on the other hand, it reduces the extortion bribes. The intuition is that because the bureaucrat cannot extract as much rents by means of extortion bribes, the mechanism is readjusted so he opts for more expropriation. This is consistent with the standard result in the insurance literature that establishes that because of moral hazard, insurance increases the risk because the agent reduces its effort to reduce the risk. In our context, the firm's effort to reduce risk corresponds to paying bribes. The overall effect of insurance on the revenue from corruption is unambiguously negative.

We next consider general situations in which firms may choose various extent of insurance coverage. We establish that the impact on the overall risk of expropriation of an increase of a firm's insurance coverage depends critically on the sign of the *firm specific* value to the bureaucrat of abusing power. When the value to the bureaucrat is positive, more insurance increases the risk. On the contrary, when the value to the bureaucrat is negative, the risk decreases with an increase of insurance coverage. Since our model covers situation with asymmetric firms, it also allows to establish some interesting results regarding individual and cross effects of insurance. An increase of insurance coverage for a given firm leads to a reallocation of the risk between different firms. When for a firm the value to the bureaucrat of abusing power is negative, an increase of this firm's insurance coverage always decreases its risk of expropriation; and, if the political constraint binds, an increase of this firm's insurance coverage increases the risk faced by the other firms. On the contrary, when the value to the bureaucrat of abusing power is positive, the impact of an increase of insurance coverage varies across the interval of possible realized profits (types) of the firm. It decreases for low types and it increases for types above some threshold value. This also implies

⁵For simplicity we assume that compensation is an exogenous variable and firms pay no premium. The issues related to the market for PRI is left for future research.

that when the firm increases its insurance coverage, the risk of expropriation of other firms may increase or decrease depending on the realized profit of the firm that increases its own insurance coverage.

We next address the question as to how insurance affects the magnitude of the extortion bribes. In our simple leading example the effect of a symmetric increase of insurance coverage is unambiguously “virtuous”, i.e., it decreases the extortion bribes. In other examples, we show however that increased insurance may have the reverse effect: it may be optimal for the bureaucrat to compensate for the insurance by asking for higher bribes from very high valued firms. We formulate conditions that secure that the extortion bribes always decrease with insurance. Finally, we establish that an increase of insurance coverage always reduces the bureaucrat’s expected income from corruption, i.e., from expropriation and bribery optimally combined.

The remaining of this article is structured as follows. In the next section we present the framework for extortion mechanisms, we derive optimal mechanisms, and we provide comparative static results for the quality of governance with respect to the expropriation value and the political constraint. In section 3 we introduce political risk insurances and characterize the modified optimal extortion mechanism. In Section 4 we investigate the impact of an increase of insurance coverage on the quality of governance. Section 5 concludes.

2 Optimal Extortion Mechanism

2.1 Basic Model

Consider a set $N = \{1, \dots, n\}$ of (risk neutral) firms exerting some activity in a weak governance country, and one (risk neutral) bureaucrat (government official) who can ask some bribes to the firms in exchange of not expropriating them. Let $N_0 = N \cup \{0\}$ be the set of all players (the n firms and the bureaucrat).

We study the risk of expropriation, the extortion power and the revenue from corruption of the bureaucrat with a mechanism design approach, assuming that the bureaucrat can fully commit to an extortion mechanism, so that firms’ bargaining power is minimized. But we also assume that the bureaucrat is unsure about the values that firms attach to non-expropriation or the maximum amount of bribes that each firm is able to pay. If the bureaucrat perfectly knew each firm’s value, he would be able to fully extort them by threatening any non-obedient firm of expropriation.

Since we assume that each firm privately knows its own value of non-expropriation (i.e., of operating), the bureaucrat has a role similar to a designer of an auction mechanism with private values. The optimal extortion mechanism that we characterize is indeed obtained by slightly adapting the design of an optimal auction in Myerson (1981). The differences between our setting and his auction model are the following:

1. The seller (bureaucrat) sells several (homogeneous) goods (a ‘good’ in our model being a guarantee of not being expropriated) and each buyer (firm) needs one good at most (each firm demands at most one guarantee not to be expropriated);
2. The seller has some political constraint on the minimal number of goods he should sell (i.e., the bureaucrat may not be able to expropriate all firms);
3. The seller’s valuation for a good depends on the types of the buyers who do not receive the good (i.e., the bureaucrat’s payoff from expropriation may depend on the values of the firms that are expropriated);
4. With a political risk insurance, a buyer’s outside option may be type dependent (i.e., a firm’s payoff when it is expropriated may depend on its type when compensation according to the insurance contract is type dependent).

Despite those differences we will show that the formal analysis is very close to the one of an optimal auction mechanism.

Without extortion we assume that firm i ’s profit from operating in the country is exogenously given by $t_i \in T_i \equiv [a_i, b_i]$, where $0 \leq a_i < b_i < +\infty$. We assume that only firm i knows the true realization of its profit or ‘‘type’’ t_i . For simplicity we assume as in Myerson (1981) that firms’ types are independently distributed. Let $f_i : T_i \rightarrow \mathbb{R}_+$ be the continuous density function for i ’s type, and F_i the corresponding cumulative distribution function.

When firm i is expropriated its payoff is independent of its type and is normalized to zero (this assumption is relaxed later, in Section 3, when we introduce political risk insurance.⁶) In contrast, the expropriation value of firm i for the bureaucrat may depend on firm i ’s type and is denoted by $e_i(t_i) \in \mathbb{R}$ (we might allow for negative value of expropriation, for example if the bureaucrat incurs a reputation or harassment cost).

A (direct revelation) mechanism is given by outcome functions $p : T \rightarrow [0, 1]^n$ and $x : T \rightarrow \mathbb{R}_+^n$. Given a profile of announced types $t = (t_1, \dots, t_n)$, $p_i(t)$ is the probability of *not* expropriating firm i and $x_i(t)$ is the expected amount of money, or bribes, paid by firm i . As in Myerson (1981), the optimal mechanism will turn out to be deterministic.

Remark 1 In full generality we should specify p and x when some firms decide not to participate to the mechanism. We do not model this situation explicitly because it is not an issue in our model. It is easy to check ex-post that the participation constraint will be satisfied in equilibrium by considering a mechanism that expropriate with probability one any firm that unilaterally deviates by non participating, so that the participation constraint is implied by the individual rationality condition (3) below. It is also easy to see that participation by all firms can be implemented in any

⁶The compensation for the case the firm is expropriated is defined as a share of profit which makes the model with insurance equivalent to a model with partial expropriation.

Nash equilibrium of the extortion mechanism by considering mechanisms that expropriate firms in an asymmetric way in case of no participation: for example, if more than one firm do not participate then the firm with the smallest index is expropriated with probability one.

Given a mechanism (p, x) the (interim) expected utility of firm i when its type is $t_i \in T_i$ is given by

$$U_i(p, x; t_i) = \int_{T_{-i}} (t_i p_i(t) - x_i(t)) f_{-i}(t_{-i}) dt_{-i}, \quad (1)$$

and the (ex ante) expected utility of the bureaucrat is

$$U_0(p, x) = \int_T \left(\sum_{i \in N} (1 - p_i(t)) e_i(t_i) + x_i(t) \right) f(t) dt. \quad (2)$$

A mechanism is feasible if it satisfies the individual rationality (IR) constraint

$$U_i(p, x; t_i) \geq 0, \quad \text{for all } i \in N, \quad (3)$$

and the incentive-compatibility (IC) constraint

$$U_i(p, x; t_i) \geq \int_{T_{-i}} (t_i p_i(s_i, t_{-i}) - x_i(s_i, t_{-i})) f_{-i}(t_{-i}) dt_{-i}, \quad \text{for all } i \in N, s_i, t_i \in T_i. \quad (4)$$

Condition (3) means that firms cannot be forced to participate to the mechanism: they should get an expected payoff which is at least the expected payoff they obtain when they are expropriated with probability one (in which case their expected payoff would be zero). Condition (4) means that firms have no incentive to misreport their types to the bureaucrat when they expect that all other firms truthfully report their types.

In addition to these standard constraints, there may also be political constraints for the designer: the bureaucrat is required to expropriate at most $K \in \{1, \dots, n\}$ firms, so that

$$\sum_{i \in N} p_i(t) \leq n - K, \quad \text{for all } t \in T. \quad (5)$$

The particular case in which there is no political constraint is simply $K = n$.

2.2 Feasible and Optimal Mechanisms

The objective of the bureaucrat is to choose the mechanism (p, x) that maximizes his expected payoff $U_0(p, x)$ under the above IR constraint (3), IC constraint (4) and political constraint (5).⁷

Let

$$Q_i(p, t_i) = \int_{T_{-i}} p_i(t) f_{-i}(t_{-i}) dt_{-i},$$

⁷As in Myerson (1981) the revelation principle applies: there is no loss of generality for optimality by focusing on direct and truthful mechanisms.

be the interim probability that firm i of type t_i is *not* expropriated given the mechanism (p, x) . Then, the IC constraint can be equivalently rewritten as

$$U_i(p, x; t_i) \geq U_i(p, x; s_i) + (t_i - s_i)Q_i(p, s_i).$$

As in Myerson (1981) it can be shown that the following lemma applies.

Lemma 1 (p, x) satisfies the IR constraint (3) and the IC constraint (4) iff for all $i \in N$ and $s_i, t_i \in T_i$ the following conditions hold:

$$Q_i(p, s_i) \leq Q_i(p, t_i) \text{ if } s_i \leq t_i; \quad (6)$$

$$U_i(p, x; t_i) = U_i(p, x; a_i) + \int_{a_i}^{t_i} Q_i(p, s_i) ds_i; \quad (7)$$

$$U_i(p, x; a_i) \geq 0. \quad (8)$$

Proof. The proof exactly follows the proof of Lemma 2 in Myerson (1981). ■

Hence, the problem of the bureaucrat is to maximize $U_0(p, x)$ given by (2) under the constraints (5), (6), (7) and (8). Using the previous lemma, the bureaucrat's objective can be rewritten: expression (2) of the bureaucrat's expected utility can be rewritten as

$$U_0(p, x) = \int_T \sum_{i \in N} e_i(t_i) f(t) dt + \int_T \sum_{i \in N} p_i(t) (t_i - e_i(t_i)) f(t) dt - \sum_{i \in N} \int_T (t_i p_i(t) - x_i(t)) f(t) dt.$$

Using (7) and then integrating by parts we get:

$$\begin{aligned} \int_T (t_i p_i(t) - x_i(t)) f(t) dt &= \int_{T_i} U_i(p, x; t_i) f(t_i) dt_i \\ &= \int_{T_i} U_i(p, x; a_i) f(t_i) dt_i + \int_{T_i} f(t_i) \int_{a_i}^{t_i} Q_i(p, s_i) ds_i dt_i \\ &= U_i(p, x; a_i) + \int_{T_i} (1 - F_i(t_i)) Q_i(p, t_i) dt_i \\ &= U_i(p, x; a_i) + \int_T \frac{1 - F_i(t_i)}{f_i(t_i)} p_i(t) f(t) dt. \end{aligned}$$

Hence:

$$U_0(p, x) = \int_T \sum_{i \in N} \left(t_i - e_i(t_i) - \frac{1 - F_i(t_i)}{f_i(t_i)} \right) p_i(t) f(t) dt + \int_T \sum_{i \in N} e_i(t_i) f(t) dt - \sum_{i \in N} U_i(p, x; a_i).$$

Choosing

$$x_i(t) = p_i(t) t_i - \int_{a_i}^{t_i} p_i(s_i, t_{-i}) ds_i, \quad (9)$$

we get

$$U_i(p, x; t_i) - \int_{a_i}^{t_i} Q_i(p, s_i) ds_i = U_i(p, x; a_i) = 0,$$

so (7) and (8) are satisfied. Since $\int_T \sum_{i \in N} e_i(t_i) f(t) dt$ is a constant, independent of the mechanism (p, x) , the optimal mechanism is given by (9) and $p : T \rightarrow [0, 1]^n$ that maximizes

$$\int_T \sum_{i \in N} \underbrace{\left(t_i - e_i(t_i) - \frac{1 - F_i(t_i)}{f_i(t_i)} \right)}_{c_i(t_i)} p_i(t) f(t) dt,$$

subject to the constraints (5) and (6). For the rest of the article we make the following standard regularity assumption, which guarantees that the state by state maximization of the program above implies that $p_i(t_i, t_{-i})$ is increasing in t_i , and thus that the monotonicity condition (6) is satisfied.

Assumption 1 (Regularity) *For every $i \in N$ the virtual type of firm i ,*

$$c_i(t_i) = t_i - e_i(t_i) - \frac{1 - F_i(t_i)}{f_i(t_i)}, \quad (10)$$

is strictly increasing in t_i .

From the previous analyzes we immediately get the following characterization of the optimal mechanism:

Proposition 1 (Optimal Extortion without Insurance) *Under regularity, the optimal extortion mechanism (p, x) is such that $p : T \rightarrow [0, 1]^n$ maximizes*

$$\sum_{i \in N} c_i(t_i) p_i(t) \quad \text{subject to} \quad n - K \leq \sum_{i \in N} p_i(t) \leq n \quad \text{for all } t \in T,$$

where the virtual type $c_i(t_i)$ of firm i is given by (10). That is, $p_i(t) = 0$ for the firms with the (up to) K lowest virtual types below 0, and $p_i(t) = 1$ for the others. The payment of firm i to the bureaucrat is given by:

$$x_i(t) = p_i(t) t_i - \int_{a_i}^{t_i} p_i(s_i, t_{-i}) ds_i, \quad \text{for all } i \in N.$$

For any finite set $\{x_1, x_2, \dots\}$ of real numbers, denote by $\min_i^K x_i$ the K th smallest element of this set. That is, if $x_1 < x_2 < \dots < x_K < \dots$, then $\min_i^K x_i = x_K$. Let

$$y_i(t_{-i}) = \min\{s_i \in T_i : c_i(s_i) \geq 0 \text{ or } c_i(s_i) \geq \min_{j \neq i}^K c_j(t_j)\}, \quad (11)$$

be the smallest type of firm i such that firm i is not expropriated when other firms' types are given by t_{-i} . The optimal mechanism can therefore be reformulated as follows:

$$p_i(t) = \begin{cases} 1 & \text{if } t_i > y_i(t_{-i}), \\ 0 & \text{if } t_i < y_i(t_{-i}), \end{cases} \quad \text{and} \quad x_i(t) = \begin{cases} y_i(t_{-i}) & \text{if } t_i > y_i(t_{-i}), \\ 0 & \text{if } t_i < y_i(t_{-i}). \end{cases} \quad (12)$$

For each firm i the optimal mechanism involves a (possibly firm specific) threshold value $c_i^{-1}(0)$ for non-expropriation which is determined so that the virtual type of firm i is equal to zero. The

threshold value plays a role similar to the reserve price in optimal auction mechanisms, and is chosen by the bureaucrat in order to maximize his expected revenue. If the bureaucrat has no political constraint ($K = n$) he never sells a promise not to expropriate a firm for a bribe below that threshold value. He sells to each firm i a promise not to expropriate at price $c_i^{-1}(0)$, and if firm i does not pay then it is expropriated. When the bureaucrat cannot expropriate as many firms as he wishes, i.e., when he is forced to sell a promise of non-expropriation to at least $n - K$ firms, he cannot obtain the threshold values from all non-expropriated firms. Instead, he must decrease the price for a non-expropriated firm i to $y_i(t_{-i})$ given by Equation (11), i.e., the highest price acceptable to the lowest non-expropriated firm i 's type. As a result the role of the threshold value in the extortion mechanism is somehow more limited the more tight the political constraint (the smaller K) and the larger the total number of firms.

When firms are ex-ante symmetric, i.e., $e_i(\cdot) = e_j(\cdot)$ and $f_i(\cdot) = f_j(\cdot)$ for every $i, j \in N$, we denote by $t_0 = c_i^{-1}(0)$ the optimal and common threshold value for non-expropriation. In that case, the optimal mechanism is much simpler. Any firm i whose type t_i is above t_0 is never expropriated ($p_i(t) = 1$). When the political constraint K is not binding (i.e., $|\{i \in N : t_i < t_0\}| < K$), every firm i whose type t_i is below t_0 is expropriated ($p_i(t) = 0$) and pays nothing, and the others are not expropriated and pay the threshold value t_0 . When the political constraint K is binding (i.e., $|\{i \in N : t_i < t_0\}| \geq K$), then only the K firms whose types are the K lowest types below t_0 are expropriated and pay nothing, and the others are not expropriated and pay the same price: $\min_{j \in N}^K t_j$, the K th lowest type in $\{t_1, \dots, t_n\}$. Notice that contrary to standard auctions, when the political constraint is binding the effective bribe ($\min_{j \in N}^K t_j$) may be strictly lower than the bureaucrat's "reserve price" (t_0).

When firms are ex-ante symmetric, the optimal mechanism can also be implemented with the following simple auction-bribing game: each firm $i \in N$ simultaneously and voluntarily submits a bid $b_i(t_i) \geq 0$ as a function of its type $t_i \in T_i$; then, up to K firms with the lowest bid below t_0 are expropriated, and the others are not expropriated and pay $\min\{t_0, \min_{j \in N}^K b_j(t_j)\}$. Observe that, like in second-price auctions, it is a weakly dominant strategy for each firm i to bid its value: $b_i(t_i) = t_i$ for every $t_i \in T_i$. Like in auction mechanisms, if firms are not ex-ante symmetric, then the optimal mechanism should also take into account each firm's identity.

The optimal extortion mechanism is illustrated in the following symmetric example with uniformly distributed types and with linear and symmetric expropriation values for the bureaucrat. The effect of asymmetries between firms is analyzed after the example.

Example 1 As an example, assume that for every $i \in N$ the profit t_i of firm i is uniformly distributed on $[0, 100]$, and the expropriation value for the bureaucrat is linear in the profit of firm i : $e_i(t_i) = \gamma t_i$, with $\gamma < 2$. Then, the virtual type of firm i is given by

$$c_i(t_i) = t_i - \gamma t_i - \frac{1 - t_i/100}{1/100} = (2 - \gamma)t_i - 100,$$

which is increasing in t_i for $\gamma < 2$, so regularity is satisfied. The (common) threshold value for non-expropriation is $c_i^{-1}(0) = t_0 = \frac{100}{2-\gamma}$. Notice that when $\gamma > 1$ the virtual type $c_i(t_i)$ of every firm i is strictly negative for every t_i , and therefore the K firms with the smallest types are *always* expropriated. On the contrary, when $\gamma < 1$ the political constraint may not always be binding: it is only binding when the types of the K firms with the K lowest types are below t_0 .

For instance, if $K = 1$ (i.e., if the bureaucrat can expropriate at most one firm), then for every firm i the optimal probability of expropriation for the bureaucrat characterized in Proposition 1 is given by:⁸

$$p_i(t_i, t_{-i}) = \begin{cases} 1 & \text{if } t_i > \min_{j \in N_0} t_j, \\ 0 & \text{if } t_i = \min_{j \in N_0} t_j. \end{cases}$$

In other words, firm i is expropriated (i.e., $p_i(t) = 0$) if and only if its type is the smallest among all firms' types (i.e., $t_i = \min_{j \in N} t_j$) and is below the threshold value for non-expropriation (i.e., $t_i < t_0 = \frac{100}{2-\gamma}$), in which case firm i pays no bribe ($x_i(t) = 0$). Otherwise, if $t_i > \min_{j \in N_0} t_j$, then firm i is not expropriated (i.e., $p_i(t) = 1$) but pays the following extortion bribe:

$$x_i(t) = p_i(t)t_i - \int_0^{t_i} p_i(s_i, t_{-i}) ds_i = t_i - \int_{\min_{j \in N_0} t_j}^{t_i} 1 ds_i = \min_{j \in N_0} t_j.$$

So if $t_i > t_0$ for every i , then no firm is expropriated and they all pay $t_0 = \frac{100}{2-\gamma}$. Otherwise, if $t_i < t_0$ for some firm i , then firm $\arg \min_{j \in N} t_j$ is expropriated and all the other firms pay $\min_{j \in N} t_j$.

More generally, when the bureaucrat can expropriate at most K firms, up to K firms with the K lowest types below $t_0 = \frac{100}{2-\gamma}$ are expropriated, and the others pay $\min\{t_0, \min_{j \in N}^K t_j\}$. Not surprisingly, if the political constraint is weaker (i.e., K is larger), then the risk of expropriation and the bribes extracted from non-expropriated firms increase. The revenue of the bureaucrat also increases with K since K only enters as a constraint in his optimization program. Finally, observe that the threshold value t_0 does not depend on the number of firms (n) and on the political constraint (K), but it is increasing in γ : the higher the expropriation value for the bureaucrat, the higher the threshold value for non-expropriation.

When firms are not ex-ante symmetric as in the example above, the optimal mechanism discriminates among different firms depending on their profit distributions and on the bureaucrat's values form expropriation. The characterization of the optimal mechanism in Proposition 1 shows that firms' heterogeneity simply introduces heterogeneity in firms' virtual type functions. This heterogeneity of virtual type functions affects firms' relative probabilities of expropriation and the extortion bribes they have to pay. To see this, consider two different firms i and j with the same profit (type) y and notice that

$$c_j(y) \geq c_i(y) \iff e_j(y) + \frac{1 - F_j(y)}{f_j(y)} \leq e_i(y) + \frac{1 - F_i(y)}{f_i(y)}.$$

⁸Recall that $N_0 = N \cup \{0\}$ is the set of all players (the n firms *and* the bureaucrat).

Hence, firm j , with a smaller value of expropriation $e_j(\cdot)$ for the bureaucrat or a higher hazard rate $\frac{f_j(y)}{1-F_j(y)}$, will be expropriated less often and will pay less bribes than firm i with the same profit y as firm i . We will see in Section 4 that the effect of insurance on the virtual types, and therefore on the probability of expropriation and on extortion bribes, is more complex and may be ambiguous.

2.3 The Quality of Governance

In this subsection we study beyond the specific example above the impact of the political constraint and of the expropriation value for the bureaucrat on the quality of governance.

In the present context it seems appropriate to capture the *quality of governance* in the host country by three indicators. The first is the overall *risk of expropriation* implied by the threshold values for non-expropriation $c_i^{-1}(0)$. Recall from Proposition 1 that firm i is never expropriated if $c_i(t_i) > 0$, i.e., $t_i > c_i^{-1}(0)$; otherwise, if $t_i < c_i^{-1}(0)$, then firm i is expropriated whenever the bureaucrat's political constraint is not binding. Hence, the threshold values determine the ex-ante probability of expropriation and thus contribute to determine the extent of the risk of expropriation. The higher the thresholds the more likely the firms' types are lower than the thresholds and therefore the more likely they could be expropriated. The second indicator of quality of governance is the *magnitude of the bribes* that firms pay to avoid being expropriated. The larger the extortion bribes, i.e., the more the firms must pay to avoid being the victims of abuse of power by the bureaucrat, the lower the quality of governance. Finally, a third indicator is the *expected revenue of the bureaucrat*, which comes both from extortion bribes and expropriation. The larger the revenues from abusing or threatening to abuse power, the lower the quality of governance.

Intuitively, one expects like in Example 1 that under the optimal extortion mechanism the values of expropriation ($e_i(t_i)$, $i = 1, \dots, n$) and the slackness of political constraint (the maximal number of feasible expropriations, K) affect negatively the quality of governance. In the two propositions below we show that this is generally true.

2.3.1 The Expropriation Value

A determinant of the virtual type of firm i , and hence of the threshold value $c_i^{-1}(0)$, is the function $e_i(\cdot) : T_i \rightarrow \mathbb{R}$ that determines the value to the bureaucrat for expropriating firm i as a function of firm i 's type $t_i \in T_i$. In Example 1 we assumed $e_i(t_i) = \gamma t_i$ and the threshold value $t_0 = \frac{100}{2-\gamma}$ was common to all firms and increasing in γ . When $t_0 < 100$, i.e., $\gamma < 1$, this implies that the ex-ante probability that any firm is expropriated is increasing with the value of the firm to the bureaucrat. It also results in higher bribes (equal to t_0) paid by firms that are not expropriated when the political constraint is not binding (bribes are constant, equal the highest firm's type among the set of expropriated firms, when the political constraint is binding). The next proposition shows that this is a general comparative statics property of the optimal mechanism, for arbitrary distributions of types and for values of expropriation that are not necessarily symmetric and linear in firms'

types.

Proposition 2 *For each firm, the probability of expropriation of this firm, the extortion bribe paid by this firm when it is not expropriated, and the revenue of the bureaucrat are increasing with the expropriation value of this firm for the bureaucrat.*

Proof. Consider an expropriation value $\tilde{e}_i(\cdot)$ of some firm $i \in N$ such that $\tilde{e}_i(t_i) > e_i(t_i)$ for every $t_i \in T_i$ and such that regularity is still satisfied. Then, the virtual type of firm i is given by $\tilde{c}_i(t_i) < c_i(t_i)$ for every $t_i \in T_i$, which implies that the threshold value for non-expropriation is $\tilde{c}_i^{-1}(0) > c_i^{-1}(0)$. Hence, the probability of expropriation of firm i and the extortion bribe paid by firm i when it is not expropriated are higher with $\tilde{e}_i(\cdot)$ than with $e_i(\cdot)$. To show that the revenue of the bureaucrat is also higher with $\tilde{e}_i(\cdot)$ than with $e_i(\cdot)$ it suffices to notice that the optimal extortion mechanism with $e_i(\cdot)$ is also feasible with $\tilde{e}_i(\cdot)$ because the expropriation values do not enter into firms' utilities, and yields the same bribe revenue but higher expropriation values. Therefore, the optimal extortion mechanism with $\tilde{e}_i(\cdot)$ necessarily yields a higher total expected revenue for the bureaucrat. ■

Notice that the overall risk of expropriation and the revenue of the bureaucrat are always smaller for smaller values of expropriation of any firm j . But decreasing the value of expropriation of some firm j may be detrimental for another firm i when the political constraint is binding and i 's type is below its threshold for non-expropriation ($t_i < c_i^{-1}(0)$). Indeed smaller values of $e_j(\cdot)$ imply higher values of j 's virtual types $c_j(\cdot)$, and hence the virtual types of any other firm i becomes smaller relative to j 's virtual type. The resulting bribe and risk of expropriation of firm i could therefore increase as $y_i(t_{-i})$ of Equation (11) increases with $c_j(\cdot)$.

2.3.2 The Political Constraint

The political constraint limits the bureaucrat's right to expropriate. When he can expropriate as many firms as he wants, the optimal mechanism calls for expropriating all the firms with $c_i(t_i) < 0$ and each remaining firm i that is not expropriated pays a fixed bribe $c_i^{-1}(0)$, which is independent of other firms' types. When the bureaucrat can expropriate at most K firms, the K firms with the K lowest virtual types below 0 are expropriated and the others pay the value of their smallest possible types allowing them not to be expropriated given others' types. Hence, the weaker the political constraint (the larger K) the larger the probability of expropriation and the bribes extracted from each firm. Since K only appears as a constraint in the bureaucrat's optimization program (through Equation (5)), his revenue is also increasing in K . Thus, we have:

Proposition 3 *The risk of expropriation, the extortion bribes paid by the firms when they are not expropriated, and the revenue of the bureaucrat are increasing with the number K of firms the bureaucrat has the power to expropriate.*

Proof. Directly from Proposition 1 and the observations above. ■

We conclude that the quality of governance is unambiguously decreasing with the value that the bureaucrat can obtain from expropriation and with the number of firms that he has the right to expropriate. The next section studies how the optimal extortion mechanism and the quality of governance are modified by the introduction of political risk insurances for the firms.

3 Optimal Extortion Mechanism with Insurance

In this section we assume that political risk insurance is available for governmental expropriation of firms' inventories, equipment, or other assets located in the country. More precisely, we assume that when firm i of type t_i is expropriated it is compensated by an amount $A_i(t_i) \geq 0$ from an insurance. We make the following monotonicity assumption so that $v_i(t_i) \equiv t_i - A_i(t_i)$ can be inverted and the optimal mechanism with insurance can be characterized with the same method as in the previous section with a change of variable.⁹

Assumption 2 For every i , $v_i(t_i) \equiv t_i - A_i(t_i)$ is strictly increasing in t_i .

A typical example in which this assumption is satisfied is when the amount of assets covered by the insurance in case of expropriation is linear in the firm's loss of income: $A_i(t_i) = \lambda_i t_i$ with $\lambda_i \in [0, 1)$, so that $v_i(t_i) = (1 - \lambda_i)t_i$.

With insurance, the interim expected utility of firm i is given by

$$\int_{T_{-i}} (t_i p_i(t) + A_i(t_i)(1 - p_i(t)) - x_i(t)) f_{-i}(t_{-i}) dt_{-i}. \quad (13)$$

The individual rationality constraint requires that this expected utility is higher than $A_i(t_i)$ or, equivalently,

$$\int_{T_{-i}} (v_i(t_i) p_i(t) - x_i(t)) f_{-i}(t_{-i}) dt_{-i} \geq 0.$$

Notice that, normalizing firms' utilities to¹⁰

$$U_i(p, x; t_i) = \int_{T_{-i}} (v_i(t_i) p_i(t) - x_i(t)) f_{-i}(t_{-i}) dt_{-i}, \quad (14)$$

we get the same IR and IC constraints as without insurance, except that the value for non-expropriation for firm i is $v_i(t_i) = t_i - A_i(t_i)$ instead of t_i . Consider indeed the following change

⁹Notice that this trick is not possible in other extensions of Myerson (1981) in which the type-dependent outside options only enter the agents' participation constraints (see, e.g., Figueroa and Skreta, 2009). In our model, the outside option $A_i(t_i)$ is perceived by the firm both when it does not participate to the mechanism at all and when it participates but is expropriated.

¹⁰ $A_i(t_i)$ is a constant, independent of the mechanism, so it can be subtracted from firm i 's interim expected utility given by (13) without modifying incentive-compatibility constraints.

of variable: $\tilde{t}_i = v_i(t_i)$. Let $\tilde{F}_i(\tilde{t}_i) = F_i(v_i^{-1}(\tilde{t}_i))$ and $\tilde{f}_i(\tilde{t}_i) = \frac{f_i(v_i^{-1}(\tilde{t}_i))}{v_i'(v_i^{-1}(\tilde{t}_i))}$ be the corresponding distribution and density of \tilde{t}_i over $\tilde{T}_i = [\tilde{a}_i, \tilde{b}_i] \equiv [v_i(a_i), v_i(b_i)]$.

With this change of variables, and for a mechanism (\tilde{p}, \tilde{x}) , where $\tilde{p} : \tilde{T} \rightarrow [0, 1]^n$ and $\tilde{x} : \tilde{T} \rightarrow \mathbb{R}_+$, players' expected utilities (1) and (2) can be rewritten as:

$$\tilde{U}_i(\tilde{p}, \tilde{x}; \tilde{t}_i) = \int_{\tilde{T}_{-i}} (\tilde{t}_i \tilde{p}_i(\tilde{t}) - \tilde{x}_i(\tilde{t})) \tilde{f}_{-i}(\tilde{t}_{-i}) d\tilde{t}_{-i}, \quad (15)$$

and

$$\tilde{U}_0(\tilde{p}, \tilde{x}) = \int_{\tilde{T}} \left(\sum_{i \in N} (1 - \tilde{p}_i(\tilde{t})) \tilde{e}_i(\tilde{t}_i) + \tilde{x}_i(\tilde{t}_i) \right) \tilde{f}(\tilde{t}) d\tilde{t}, \quad (16)$$

where $\tilde{e}_i(\tilde{t}_i) = e_i(v_i^{-1}(\tilde{t}_i))$. The optimal mechanism can therefore be characterized exactly as in the previous subsection, which yields the following virtual type for each firm i :

$$c_i(t_i) = \tilde{t}_i - \tilde{e}_i(\tilde{t}_i) - \frac{1 - \tilde{F}_i(\tilde{t}_i)}{\tilde{f}_i(\tilde{t}_i)} = v_i(t_i) - e_i(t_i) - v_i'(t_i) \frac{1 - F_i(t_i)}{f_i(t_i)}.$$

Again, we make the following regularity assumption:

Assumption 3 (Regularity with insurance) *For every $i \in N$ the virtual type of firm i with insurance,*

$$c_i(t_i) = v_i(t_i) - e_i(t_i) - v_i'(t_i) \frac{1 - F_i(t_i)}{f_i(t_i)}, \quad (17)$$

is strictly increasing in t_i .

The optimal mechanism (p, x) defined on the original types, $p : T \rightarrow [0, 1]^n$ and $x : T \rightarrow \mathbb{R}_+$, is such that $p_i(t) = \tilde{p}_i(v_1(t_1), \dots, v_n(t_n))$ and $x_i(t) = \tilde{x}_i(v_1(t_1), \dots, v_n(t_n))$. We therefore get the following characterization of the optimal extortion mechanism with insurance:

Proposition 4 (Optimal Extortion with Insurance) *Under regularity the optimal extortion mechanism (p, x) with insurance is such that $p : T \rightarrow [0, 1]^n$ maximizes*

$$\sum_{i \in N} c_i(t_i) p_i(t) \quad \text{subject to} \quad n - K \leq \sum_{i \in N} p_i(t) \leq n \quad \text{for all } t \in T,$$

where the virtual type $c_i(t_i)$ of firm i is given by (17). That is, $p_i(t) = 0$ for the firms with the (up to) K lowest virtual types below 0, and $p_i(t) = 1$ for the others. The payment of firm i to the bureaucrat is given by:

$$x_i(t) = p_i(t) v_i(t_i) - \int_{v_i(a_i)}^{v_i(t_i)} p_i(s_i, t_{-i}) ds_i. \quad (18)$$

The optimal mechanism with insurance can be reformulated in terms of the initial types: if

$$y_i(t_{-i}) = \min\{s_i \in T_i : c_i(s_i) \geq 0 \text{ or } c_i(s_i) \geq \min_{j \neq i}^K c_j(t_j)\},$$

is the smallest type of firm i that would result in firm i not being expropriated when other firms' types are given by t_{-i} , the optimal mechanism can be rewritten as:

$$p_i(t) = \begin{cases} 1 & \text{if } t_i > y_i(t_{-i}), \\ 0 & \text{if } t_i < y_i(t_{-i}). \end{cases} \quad \text{and} \quad x_i(t) = \begin{cases} v_i(y_i(t_{-i})) & \text{if } t_i > y_i(t_{-i}), \\ 0 & \text{if } t_i < y_i(t_{-i}). \end{cases} \quad (19)$$

Example 1 continued Consider again Example 1 and let $v_i(t_i) = t_i - A_i(t_i) = (1 - \lambda)t_i$, where $\lambda \in [0, 1)$, so all firms have the same insurance coverage. Then, the virtual type of firm i as a function of its type t_i is given by:

$$c_i(t_i) = (1 - \lambda)t_i - \gamma t_i - (1 - \lambda)(100 - t_i) = [2(1 - \lambda) - \gamma]t_i - 100(1 - \lambda).$$

Assume that λ and γ are not too high: $2(1 - \lambda) - \gamma > 0$, i.e. $\lambda < 1 - \gamma/2$, so that regularity is satisfied. Then, the (common) threshold for non-expropriation is given by:

$$t_0 = c_i^{-1}(0) = \frac{100(1 - \lambda)}{2(1 - \lambda) - \gamma} = \frac{100}{2 - \frac{\gamma}{1 - \lambda}},$$

and up to K firms with the K lowest types below t_0 are expropriated. The non-expropriated firms pay $\min\{(1 - \lambda)t_0, \min_{j \in N}^K (1 - \lambda)t_j\}$; that is, they pay $(1 - \lambda)t_0$ when the political constraint is not binding (i.e., strictly less than K firms are below t_0), and they pay $\min_{j \in N}^K (1 - \lambda)t_j$ when the political constraint is binding.

The threshold t_0 , and therefore the risk of expropriation, is increasing with λ when $\gamma > 0$, but decreasing with λ when $\gamma < 0$. The extortion bribes paid by the firms when the political constraint is binding, $\min_{j \in N}^K (1 - \lambda)t_j$ is obviously always strictly decreasing with λ . When the political constraint is not binding, the payment $(1 - \lambda)t_0$ applies and it is also strictly decreasing in λ when

$$\frac{\partial}{\partial \lambda} (1 - \lambda)t_0 = \frac{\partial}{\partial \lambda} \frac{100(1 - \lambda)}{2 - \frac{\gamma}{1 - \lambda}} < 0, \text{ that is } \lambda < 1 - \gamma.$$

When the inequality above is not satisfied (i.e., when $\lambda \geq 1 - \gamma$) we have $t_0 \geq 100$, so the risk of expropriation is constant and the political constraint is always binding. Hence, the payment $\min_{j \in N}^K (1 - \lambda)t_j$ always applies for the $n - K$ non-expropriated firms, and therefore the bribes and the expected revenue of the bureaucrat decrease with λ . We conclude that, in this example, extortion bribes paid by the firms that are not expropriated always decrease with the extent λ of the insurance coverage. These comparative statics results with respect to the coverage of the political risk insurances are generalized in the next section.

4 The Quality of Governance with Insurance

In this section we study the quality of governance as a function of firms' insurance coverage. More precisely, we study the impact of the extent of insurance on the three indicators of the quality of governance defined in Subsection 2.3: (i) the risk of expropriation, (ii) the magnitude of the extortion bribes, and (iii) the bureaucrat's expected revenue from corruption.

4.1 Risk of Expropriation

In our leading symmetric example, the (common) threshold value for non-expropriation, t_0 , is increasing in λ when the value of expropriation for the bureaucrat is positive ($\gamma > 0$). Since a larger threshold implies a higher probability that any firm's type is below this threshold, a larger insurance coverage implies an overall higher probability of expropriation. Recall that the optimal mechanism calls for the K -lowest types below that threshold to be expropriated. Therefore, whenever the political constraint binds at a given level of insurance coverage, it binds at any higher level. In such a case an increase in insurance coverage has no impact on the risk of expropriation.

We show below that the result is true beyond the specific example whenever the value for expropriation is positive for the bureaucrat (i.e., when $e_i(t_i)$ is always positive), at least with linear insurance coverage. On the contrary, the threshold for expropriation decreases with insurance coverage when the value of expropriation for the bureaucrat is negative, and insurance has no impact on the risk of expropriation when expropriation has no value for the bureaucrat. At the end of the subsection we study precisely the impact of asymmetric insurances coverage on firms' *relative* risk of expropriation when the political constraint of the bureaucrat is binding.

When insurance is linear in firms' types (i.e., $A_i(t_i) = \lambda_i t_i$, $\lambda_i \in [0, 1)$), the individual threshold value for non-expropriation of firm i , $c_i^{-1}(0)$, is the solution t_0^i of $c_i(t_0^i) = 0$, i.e.,

$$t_0^i - \frac{e_i(t_0^i)}{1 - \lambda_i} - \frac{1 - F_i(t_0^i)}{f_i(t_0^i)} = 0.$$

The LHS of this equation is decreasing in λ_i when $e_i(t_0^i) > 0$, so when the regularity condition is satisfied (i.e., $c_i(\cdot)$ is increasing) a larger insurance coverage λ_i requires a higher threshold value for the LHS of the equation to be equal to 0. Similarly, when $e_i(t_0^i) < 0$, the threshold value decreases in λ_i , and when $e_i(t_0^i) = 0$ the threshold value does not depend on the percentage of insurance coverage. This gives us the following proposition.¹¹

Proposition 5 *Assume that insurance is linear: $A_i(t_i) = \lambda_i t_i$, $\lambda_i \in [0, 1)$. The impact of the percentage λ_i of insurance coverage of firm i on the threshold value $c_i^{-1}(0)$ of non-expropriation of firm i depends on the sign of the expropriation value function $e_i(\cdot)$ for the bureaucrat: The threshold for non-expropriation increases (decreases) with λ_i when $e_i(\cdot) > 0$ ($e_i(\cdot) < 0$), and does not depend on λ_i when $e_i(\cdot) = 0$.*

Thus, we learn that the impact of insurance on the risk of expropriation critically depends on the sign of the expropriation value for the bureaucrat. The interpretation is that if the bureaucrat's extortion power builds on an ability to seize the assets and benefit from them, then the risk increases with insurance. In contrast if his power builds on a capacity to create costly nuisance for the firms, the risk is unchanged if harassment is costless and it decreases if harassment is costly.

¹¹The result can also be obtained as a direct application of the implicit function theorem.

The threshold values have an impact on the risk of expropriation since any type above this threshold is certain not to be expropriated. When the political constraint is not binding the risk of expropriation of a firm $j \neq i$ is not affected by the insurance coverage of firm i because the virtual type, and therefore the threshold for non-expropriation of firm j , $c_j^{-1}(0)$, does not depend on λ_i . But when the political constraint is binding there exists interesting cross effects among different firms. The risk of expropriation of a given firm whose type is below its threshold depends on the relative position of its virtual type with respect to other firms' virtual types below zero. To see the effect of insurance on the virtual type $c_i(t_i)$ of firm i , and hence on the relative probabilities of expropriation, assume again linear insurances. Then, we have:

$$\frac{\partial c_i(t_i)}{\partial \lambda_i} < 0 \iff t_i > \frac{1 - F_i(t_i)}{f_i(t_i)}. \quad (20)$$

Notice that by regularity, $t_i - \frac{1 - F_i(t_i)}{f_i(t_i)}$ is strictly increasing in t_i .

Denote by t_i^* the solution of $t_i^* - \frac{1 - F_i(t_i^*)}{f_i(t_i^*)} = 0$. Since $c_i^{-1}(0)$ solves

$$c_i^{-1}(0) - \frac{1 - F_i(c_i^{-1}(0))}{f_i(c_i^{-1}(0))} - \frac{e_i(c_i^{-1}(0))}{1 - \lambda_i} = 0,$$

we have $c_i^{-1}(0) > t_i^*$ when $e_i(\cdot) > 0$, in which case $c_i^{-1}(0)$ increases with λ_i in accordance with Proposition 5. We also have $c_i^{-1}(0) < t_i^*$ when $e_i(\cdot) < 0$, in which case $c_i^{-1}(0)$ decreases with λ_i , so the risk of expropriation never increases in that case (it strictly decrease when $t_i < c_i^{-1}(0)$ and is null and constant when $t_i > c_i^{-1}(0)$). This is illustrated in Figure 1 with two levels of insurance coverage $\bar{\lambda}_i$ and $\underline{\lambda}_i$, with $\bar{\lambda}_i > \underline{\lambda}_i$ and the corresponding virtual type functions $\bar{c}_i(\cdot)$ and $\underline{c}_i(\cdot)$ and threshold values $\bar{t}_0^i = \bar{c}_i^{-1}(0)$ and $\underline{t}_0^i = \underline{c}_i^{-1}(0)$. In the figure on the LHS we have $e_i(\cdot) > 0$, and in the figure on the RHS we have $e_i(\cdot) < 0$. Notice that even when $e_i(\cdot) = 0$, the risk of expropriation of firm i decreases with λ_i for $t_i < t_i^* = c_i^{-1}(0)$ when the political constraint is binding (because $c_i(t_i)$ increases for $t_i < t_i^*$), although the threshold value $c_i^{-1}(0)$ does not change with λ_i (so that the risk of expropriation is null and independent of λ_i for $t_i > t_i^* = c_i^{-1}(0)$).

As an example consider the case of two firms with $K = 1$, and assume that both firms are initially symmetric, $e_1(\cdot) = e_2(\cdot) > 0$, $t_1^* = t_2^* = t^*$, with a low insurance coverage $\underline{\lambda}$ and $c_1(\cdot) = c_2(\cdot) = \underline{c}(\cdot)$. Consider first the case in which firm 1's type is t_1 and firm 2's type is t_2 , with $t_1 < t_2 < t^* < \underline{c}^{-1}(0)$ as in Figure 2. Under the common low insurance coverage, firm 1 is expropriated, but not firm 2, because $\underline{c}(t_1) < \underline{c}(t_2) < 0$. But if firm 1 increases its insurance coverage to $\bar{\lambda}$ (yielding the virtual type function $\bar{c}(\cdot)$ represented in Figure 2), then the role are switched: firm 2 is expropriated because $\underline{c}(t_2) < \bar{c}(t_1) < 0$. The contrary may obtain for higher types. Indeed, consider now the case in which firm 1's type is s_1 and firm 2's type is s_2 , with $s_1 > \underline{c}^{-1}(0) > s_2$. With a common low insurance coverage, firm 2 is expropriated because $\underline{c}(s_2) < 0 < \underline{c}(s_1)$. If firm 1 increases its insurance to $\bar{\lambda}$ as before, the role are reversed: firm 1 is expropriated while firm 2 is not since $\underline{c}(s_2) > \bar{c}(s_1)$.

The following proposition summarizes some of the observations above.

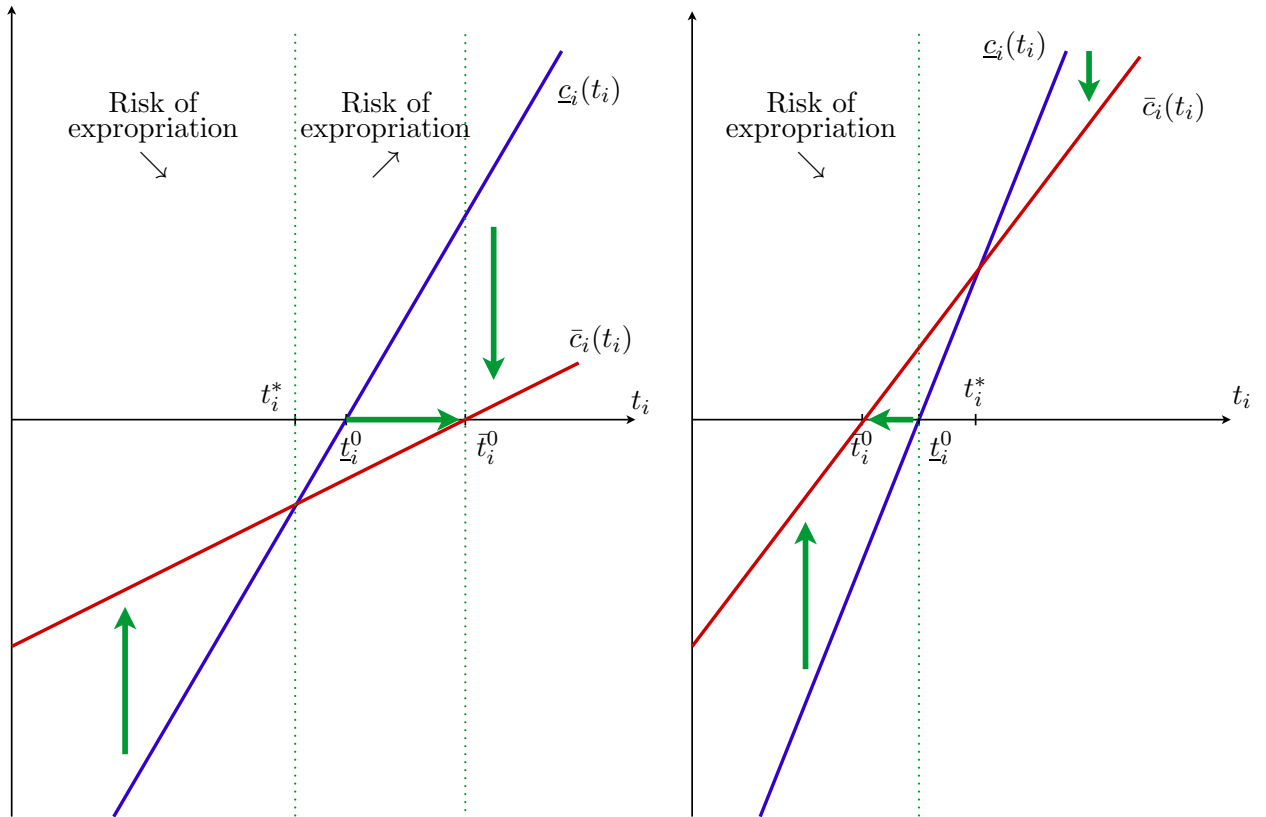


Figure 1: The effect of an increase of insurance coverage from $\underline{\lambda}_i$ to $\bar{\lambda}_i > \underline{\lambda}_i$ when $e_i(\cdot) > 0$ (figure on the left) and when $e_i(\cdot) < 0$ (figure on the right) on the virtual type of firm i and its risk of expropriation.

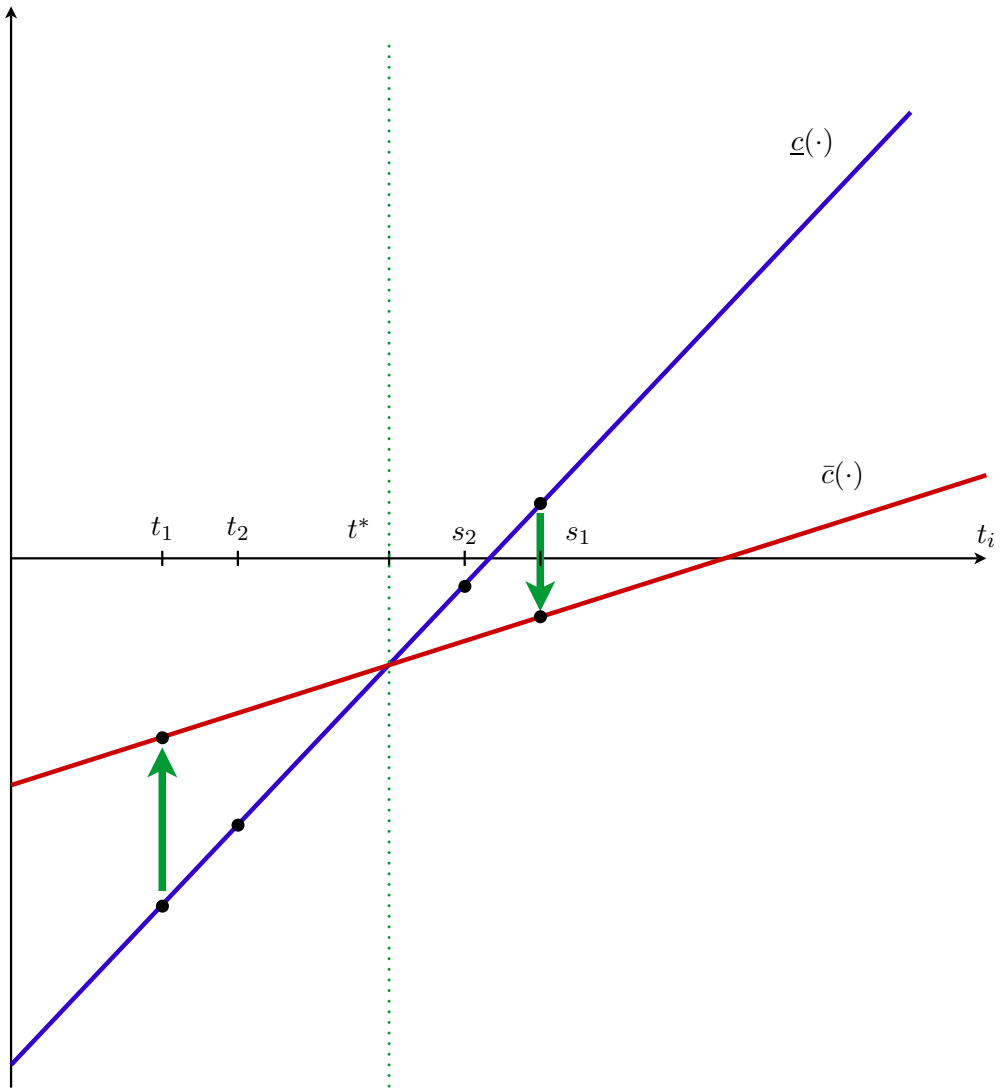


Figure 2: Cross effects of insurance coverage with two initially symmetric firms, when firm 1's insurance coverage increases.

Proposition 6 *Assume that insurance is linear: $A_i(t_i) = \lambda_i t_i$, $\lambda_i \in [0, 1)$, and let t_i^* be the solution of $t_i^* - \frac{1-F_i(t_i^*)}{f_i(t_i^*)} = 0$. If the insurance coverage of firm i , λ_i , increases, then*

- *The risk of expropriation of firm i decreases for low types: for $t_i < t_i^* < c_i^{-1}(0)$ if $e_i(\cdot) > 0$, and for $t_i < c_i^{-1}(0) < t_i^*$ if $e_i(\cdot) < 0$;*
- *The risk of expropriation of firm i increases only if $e_i(\cdot) > 0$ and for intermediate types $t_i > t_i^*$ below the threshold of non-expropriation.*
- *When the political constraint is binding, the risk of expropriation of another firm $j \neq i$ increases for low types of firm i ($t_i < t_i^*$) and it decreases for high types of firm i ($t_i > t_i^*$).*

4.2 Extortion Bribes

If we consider a simple insurance relationship, there exists a standard result related to moral hazard saying that the more insured an agent the less effort she makes to reduce risk. In the context of extortion, firms pay bribes to reduce the risk of expropriation. This suggests that we could expect that the more insured a firm the less bribe it pays. Indeed, we shall see that this is the case most of the time in our extortion game. Note that from a private insurance company's point of view moral hazard is an issue because as the risk increases, the company will have to pay out the compensation more often. However, from the point of view of governance moral hazard is a blessing because the magnitude of the bribe is negatively related to governance. While the results from the insurance literature do have some relevance, the extortion game that we consider is substantially different from a bilateral contractual insurance relationship. We next study how the extortion bribes paid by the firms that are not expropriated varies with insurance coverage.

In Example 1, with ex-ante symmetric firms and a uniform distribution of types, we have seen that extortion bribes paid by firms that are not expropriated decrease with the extent of the (common) insurance coverage λ . The next proposition provides more general sufficient conditions under which the extortion bribes decrease with own insurance coverage.

Proposition 7 *Assume that insurance is linear: $A_i(t_i) = \lambda_i t_i$, $\lambda_i \in [0, 1)$. The magnitude of the bribes firm i must pay to avoid being expropriated is decreasing in the extent of insurance coverage λ_i under the following conditions:*

(i) *The expropriation value is negative ($e_i(t_i) < 0$ for every $t_i \in T_i$) or, more generally, when it is not too high for all types below the threshold for non-expropriation:¹²*

$$e_i(t_i) \leq t_i c_i'(t_i) - c_i(t_i), \text{ for every } t_i \leq t_i^0; \quad (21)$$

(ii) *Firm i 's type is not too high: $t_i < \frac{1-F_i(t_i)}{f_i(t_i)}$.*

¹²Of course, $e_i(t_i) < 0$ for every $t_i \in T_i$ implies (21) under the regularity condition since in that case we have $c_i'(t_i) > 0$ and $c_i(t_i) < 0$ for every $t_i \leq t_i^0$.

Proof. (i) From the characterization of the optimal mechanism with insurance (Proposition 4 and below), the extortion bribe paid by firm i when it is not expropriated is equal to $(1 - \lambda_i)y_i(t_{-i})$, where

$$y_i(t_{-i}) = \min\{s_i \in T_i : c_i(s_i) \geq 0 \text{ or } c_i(s_i) \geq \min_{j \neq i}^K c_j(t_j)\}.$$

Consider a given profile of types t_{-i} of the other firms and let

$$\alpha = \min\{0, \min_{j \neq i}^K c_j(t_j)\},$$

so that the bribe paid by firm i can be rewritten as

$$(1 - \lambda_i)c_i^{-1}(\alpha).$$

It is decreasing in λ_i if

$$\frac{\partial(1 - \lambda_i)c_i^{-1}(\alpha)}{\partial \lambda_i} < 0, \quad \text{i.e.,} \quad \frac{\partial c_i^{-1}(\alpha)}{\partial \lambda_i} < \frac{c_i^{-1}(\alpha)}{1 - \lambda_i}. \quad (22)$$

We have

$$c_i(\theta) = \alpha \iff \theta - \frac{e_i(\theta)}{1 - \lambda_i} - \frac{1 - F_i(\theta)}{f_i(\theta)} - \frac{\alpha}{1 - \lambda_i} = 0.$$

Using the implicit function theorem, Equation (22) can be rewritten as

$$\frac{\frac{e_i(\theta) + \alpha}{(1 - \lambda_i)^2}}{1 - \frac{e_i'(\theta)}{1 - \lambda_i} - \frac{\partial\left(\frac{1 - F_i(\theta)}{f_i(\theta)}\right)}{\partial \theta}} < \frac{\theta}{1 - \lambda_i},$$

which simplifies to

$$e_i(\theta) < \theta c_i'(\theta) - c_i(\theta).$$

(ii) We know from Equation (20) that when $t_i < \frac{1 - F_i(t_i)}{f_i(t_i)}$, the virtual type $c_i(t_i)$ of type t_i increases (see also Figure 1). From the characterization of the optimal mechanism with insurance (Proposition 4 and below) this implies that $y_i(t_{-i})$ decreases with λ_i , and therefore also the payment $(1 - \lambda_i)y_i(t_{-i})$ for any non-expropriated type. ■

Hence, we see that an increase in the extent of insurance coverage λ_i of firm i decreases the magnitude of the extortion bribes paid by firm i except when the firm's type is high and the expropriation value of this firm is positive and large enough for the bureaucrat.

To see that an increase in firm i 's insurance coverage can lead to an increase in the bribe it must pay to avoid expropriation, assume as in Example 1 that $e_i(t_i) = \gamma t_i$ for every i and $t_i \in T_i$, and therefore $c_i(\cdot) = c(\cdot)$, we have

$$c(t_0) = 0 \iff t_0 - \frac{1 - F(t_0)}{f(t_0)} - \frac{\gamma t_0}{1 - \lambda} = 0.$$

By the implicit function theorem we have:

$$\frac{\partial t_0}{\partial \lambda} = \frac{\gamma t_0 / (1 - \lambda)^2}{1 - \frac{\partial \frac{1-F(t_0)}{f(t_0)}}{\partial t_0} - \frac{\gamma}{1-\lambda}},$$

which is positive when $\gamma > 0$ in accordance with Proposition 5. The extortion bribe when the political constraint does not bind is decreasing in λ if

$$\frac{\partial(1 - \lambda)t_0}{\partial \lambda} < 0,$$

i.e.,

$$(1 - \lambda) \left(1 - \frac{\partial \frac{1-F(t_0)}{f(t_0)}}{\partial t_0} \right) > 2\gamma. \tag{23}$$

With a uniform distribution of types like in Example 1 we have $\frac{\partial \frac{1-F(t_0)}{f(t_0)}}{\partial t_0} = -1$ so the previous inequality simplifies to $\lambda < 1 - \gamma$, which is always satisfied when t_0 is below the upper bound of the (uniform) distribution of the firm's type. But for the exponential distribution $F(t_i) = 1 - e^{-ht_i}$, which has a constant hazard rate $h = \frac{f(t_0)}{1-F(t_0)} > 0$, Equation (23) is equivalent to $\lambda < 1 - 2\gamma$. Hence, for values of the parameters satisfying

$$1 - 2\gamma < \lambda < 1 - \gamma,$$

and when the political constraint does not bind, any type above

$$t_0 = \frac{1 - \lambda}{h(1 - \lambda - \gamma)},$$

pays an increasing amount of bribes, equal to $(1 - \lambda)t_0 = \frac{(1-\lambda)^2}{h(1-\lambda-\gamma)}$, as the insurance coverage λ increases.

We end this section by illustrating some cross effects of insurance coverage on extortion bribes paid by other firms. Consider again the case analyzed in Figure 2 in which there is two firms, $K = 1$, both firms are initially symmetric, $e_1(\cdot) = e_2(\cdot) > 0$, $t_1^* = t_2^* = t^*$, with a low insurance coverage $\underline{\lambda}$ and $c_1(\cdot) = c_2(\cdot) = \underline{c}(\cdot)$, firm 1's type is t_1 and firm 2's type is t_2 , with $t_1 < t_2 < t^* < \underline{c}^{-1}(0)$. We have seen that an increase of the insurance coverage of firm 1 (to $\bar{\lambda}$, yielding the virtual type function $\underline{c}(\cdot)$), could reduce its expropriation risk (to zero) at the expense of firm 2 of type t_2 . Consider now what happens with a third firm (firm 3) which is ex-ante identical to firm 2 but has a higher type $t_3 > t_2$, so it is not expropriated in this configuration. Before firm 1 increased its insurance, type t_3 of firm 3 was paying a bribe equal to $(1 - \underline{\lambda})t_1$, but after firm 1 has increased its insurance it pays $(1 - \underline{\lambda})t_2$ which is larger. There is a positive cross effect of firm 1's insurance coverage on firm 3's bribe.

¹³This expression can also directly be obtained from Equation (21) in Proposition 7 for $t_i = t_i^0$.

4.3 Revenue from Corruption

The third governance indicator is the total revenue from corruption (including from expropriation and from bribery). The next proposition establishes that it always decreases with insurance coverage i.e., the more insured the firms the less rents the bureaucrat is able to extract from them.

Proposition 8 *Assume that insurance is linear: $A_i(t_i) = \lambda_i t_i$, $\lambda_i \in [0, 1)$. The bureaucrat's expected revenue from corruption including proceeds from expropriation and bribery is decreasing with λ_i , the extent of insurance coverage of any firm i .*

Proof. Consider the optimal mechanism with insurance $(\lambda_1, \dots, \lambda_n)$. According to the characterization of the optimal mechanism with insurance of Proposition 4, the firms with the K -lowest virtual types below their threshold t_i^0 are expropriated and each other firm i pays $(1 - \lambda_i) y_i(t_{-i})$.

Assume now that each firm's insurance coverage decrease to $(\tilde{\lambda}_1, \dots, \tilde{\lambda}_n) \leq (\lambda_1, \dots, \lambda_n)$, with $\tilde{\lambda}_i < \lambda_i$ for at least one firm i . Consider the mechanism that is optimal with the profile of insurance coverage $(\lambda_1, \dots, \lambda_n)$ but we now let each firm i pay $(1 - \tilde{\lambda}_i) y_i(t_{-i})$ instead of $(1 - \lambda_i) y_i(t_{-i})$ when it is not expropriated. While this new mechanism is not optimal under the profile of insurance coverage $(\tilde{\lambda}_1, \dots, \tilde{\lambda}_n)$ (in particular, a change of the insurance coverage calls for a change in the virtual type functions, and thus a change in the thresholds for non-expropriation) it improves the bureaucrat total expected payoff because the bureaucrat's revenue from expropriation is exactly the same as before but the revenue from bribery is larger. It remains to show that this mechanism is incentive compatible. For that, it suffices to observe that:

(i) With the original mechanism and the profile of insurance coverage $(\lambda_1, \dots, \lambda_n)$, the (normalized) expected payoff of firm i when its type is t_i (see Equation (14)) is equal to

$$U_i(t_i) = \int_{\{t_{-i}: y_i(t_{-i}) < t_i\}} (1 - \lambda_i)(t_i - y_i(t_{-i})) f_{-i}(t_{-i}) dt_{-i},$$

(ii) With the modified mechanism and the profile of insurance coverage $(\tilde{\lambda}_1, \dots, \tilde{\lambda}_n)$, the (normalized) expected payoff of firm i when its type is t_i is equal to

$$\tilde{U}_i(t_i) = \int_{\{t_{-i}: y_i(t_{-i}) < t_i\}} (1 - \tilde{\lambda}_i)(t_i - y_i(t_{-i})) f_{-i}(t_{-i}) dt_{-i}.$$

Since $\tilde{U}_i(t_i) = \frac{1 - \tilde{\lambda}_i}{1 - \lambda_i} U_i(t_i)$ for every $t_i \in T_i$ and $i \in N$, the IR and IC constraints in situation (i) imply the IR and IC constraints in situation (ii). We conclude that lower levels of insurance coverage are associated with a larger revenue from corruption, and thus higher levels of insurance coverage decrease the bureaucrat's expected revenue from corruption. ■

In contrast with the two previous governance indicators (risk of expropriation and the bribe), the impact of insurance on revenue is unambiguous. Hence, even if the optimal mechanism may call

for more expropriation and, in some cases, for larger bribes for high type firms, the total expected revenue from corruption always decreases as insurance coverage increases. This important result means that the adjustments of the optimal mechanism in the level of bribes and expropriation risk in response to an increase in insurance coverage cannot undo the impact of insurance on the bureaucrat's extortion ability – it is reduced.

5 Concluding remarks

Summing up the analysis above, we find that the impact of insurance on governance is somehow ambiguous. We have chosen to measure governance with three indicators, the risk for expropriation, the magnitude of the bribes and the expected revenue from corruption. The least problematic indicator is the expected revenue from corruption. It always decreases with insurance, at least under our assumption that insurance coverage is linear. The relationship between the magnitude of the extortion bribes at the individual level and the extent of insurance coverage is more complex. While the extortion bribes paid by a firm decrease under a wide range of circumstances (in particular, the extortion bribes paid by a firm always decrease with its own insurance coverage when the expropriation value for the bureaucrat or the profit of the firm are not too high), we identified circumstances under which a high type could end up paying more bribes with a higher insurance coverage. We have also shown that insurances induce cross effects between firms: a firm might pay higher bribes when another firm increases its insurance coverage. Finally, but not surprisingly, the risk for expropriation is the most problematic indicator. Indeed, insurance reduces the total amount that can be extorted in bribes but it leaves the value of expropriation unaffected, so the trade-off between the two means of extracting rents is affected, and expropriation becomes relatively more attractive for the bureaucrat. It is not surprising therefore that the risk increases whenever the value of expropriation for the bureaucrat is positive. These results are consistent with basic results from the insurance literature. When a firm increases its insurance, it makes less effort to reduce the risk. When an MNC subscribes a PRI, it is willing to pay less bribes to reduce the risk of expropriation which results in higher risk.

Our results reveal the critical role played by the value of expropriated assets for the bureaucrat. We learned that when it is negative, as in the case of pure harassment, the impact of insurance is unambiguously positive along all three indicators. It is only when the value is positive that the risk of expropriation increases with insurance coverage and when it is positive and large enough that the bribe of the high types may increase. It is therefore interesting to consider ways to reduce the value of expropriation. One way to do so is for the insurance companies to seek the recovery of assets from the responsible bureaucrat. While this is typically quite difficult, MIGA devotes substantial effort to asset recovery at the level of central government. When the central government can hold the bureaucrat accountable (i.e., when the value of expropriation for the bureaucrat is effectively reduced), this policy may secure that PRI's impact on governance is unambiguously positive. This

implies that we expect a better outcome in terms of PRI's impact on governance in countries where the central government has some control over its bureaucracy (as in many Latin American countries). In contrast, the impact of PRI on governance in the weakest governance countries (e.g., some African failed states) has some limitations.

This article leaves many issues open for future research. In particular, we have adopted the mechanism design approach which allows to establish results at a level of great generality. But the mechanism design approach relies on a pretty strong commitment assumption: the bureaucrat commits to the mechanism at the beginning and implements it even if he ex-post would prefer to act differently. While this is a natural first step, alternative settings that may be more attractive from an implementation point of view should be addressed. One example includes the case in which the bureaucrat makes a take-it-or-leave-it offer of a bribe in exchange for leaving a firm alone. The firms accept or refuse, thereafter the bureaucrat chooses what is best for him to do. Alternatively we could consider the case in which the firms make the bribe proposals. Finally, in the present article, firms bear no cost of insurance and they are captive. An interesting question for future research is to introduce some premium and study firms' decision to make investment and to subscribe to PRI.

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