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Does Competition within the Military Reduce Expropriation?

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Abstract

How can agents in the military, which control the means of coercion, commit not to expropriate from producers? In this paper we propose competition within the military as one of the mechanisms that can deter predation and consequently create commitment. In our model, even if agents within the military could expropriate all output costlessly, it is attractive to protect producers from predating military units. This is because there is a marginal defensive advantage and consequently defense is an effective way to potentially eliminate other military units, reducing competition and leading to higher future payoffs. The model predicts that that greater internal competition within the military lowers the risk of expropriation. We find robust correlations in the data that suggest that the competition effect we model can explain short run fluctuations in the expropriation risk within countries for countries at lower stages of institutional and economic development. These results indicate that there may be a short run component to property rights institutions that varies with the degree competition among agents who control the means of coercion.

Keywords: property rights; military power; checks and balances; institutions

JEL classification: D02, D72, D74, H56, O12

1 Introduction

The enforcement of property rights and contractual agreements ultimately depends on the presence of agents, such as the police or the military, who can use coercive power to punish those who violate them. But how can these agents commit not to abuse this power for their

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own gain? This commitment is important since the possibility of ex-post expropriation would seriously undermine incentives for ex-ante investments leading to poor economic outcomes.[1]

Our answer to this question of "who guards the guards themselves?" is that "the guards guard each other", that is, competition between agents in the military and in particular, their inability to commit not to turn against one another, keeps predatory behaviour at bay. In our model, even if these agents could expropriate all output costlessly, it is attractive to protect producers from predators. This is because there is a marginal defensive advantage and consequently defense is an effective way to potentially eliminate competitors since a reduction in competition leads to higher future payoffs. Producers can therefore engineer a Prisoner's dilemma that exploits the desire of agents with coercive power to get rid of competitors, to threaten potential predators with elimination.

To illustrate the basic insight of our model more concretely, suppose there are two generals, commanding equally powerful armies, with no external threats. If they both decide to predate they take all output and keep half each. If they both decide to defend then they are paid a transfer, which we can think of as a tax or salary or even protection money, by the producers and do nothing. But if one of them defends and the other predates, then the defensive advantage implies that their probabilities of victory are greater than and less than half, respectively. If the defender wins then he will be the sole general left, so that he will be able to take all output for himself. Whoever loses the fight gets nothing. In this game, when the other general chooses to predate, the payoff from defense consists of output times the probability of winning, which is greater than a half. On the other hand, the payoff from colluding with the predating general is only half of output since they share output equally. Producers can therefore avoid predation by offering a transfer that makes each general prefer taking that transfer and doing nothing to being a predator fighting against the other general. This is how competition between the two generals lowers the level of expropriation.

By extending this logic to the case of many specialists in violence[2], we show that the proportion of output that each specialist in violence obtains in the form of transfers is decreasing in the number of units. Our model easily accommodates heterogeneity in strength among specialists in violence and we show how the level of expropriation is decreasing as the distribution of strength becomes more equal. Our paper makes the point that increasing competition among specialists in violence, both by increasing their numbers and making their strengths more equal is beneficial to producers, which is in line with the intuition that making power more diffuse reduces its abuse.

We test this model using a panel of 168 countries over 11 years. Using within-country variation in expropriation risk we document a robust negative correlation between the risk of expropriation and the number of military units in a country. We find that this effect appears to be significant for countries below the 30th percentile of economic and institutional development and attenuates with increasing development. Our results are consistent with the

[1] See Besley and Ghatak (2010) for an overview of links between expropriation and economic outcomes.

[2] We follow North et al. (2009) in using this term to refer to agents with control of coercive power.

idea that the risk of expropriation faced by producers from specialists in violence is salient for countries at a less advanced stage of institutional and economic development.

Our paper is complementary to the research agenda that seeks to identify the determinants of long run institutions. This literature shows how variables such as factor endowments (Engerman and Sokoloff (2000)), legal origins (Djankov et al. (2003)), and colonial history (Acemoglu et al. (2001)) can explain long run cross country differences in institutions. Our findings suggest that in addition to the time invariant component of institutions that has been emphasised in this literature there may also be a short-run component. Our results suggest that this short-run component to property rights institutions fluctuates with the changes in the parameters of the game that characterises the interaction among players who underpin the existence of these institutions through their exclusive control of coercive power. In particular, our results indicate that a greater degree of internal competition among specialists in violence is associated with stronger property rights institutions.

Our paper also contributes to the large literature in economics and political science that attempts to explain the existence of the commitment by those who have power to expropriate. The main thrust of the existing literature is that commitment arises as a consequence of the repeated nature of the game between agents who specialise in production and specialists in violence. In a one-shot game producers anticipate predation at the end of the period and this leads to no investment in equilibrium.[3] But if this interaction is repeated infinitely, producers can play trigger strategies that make it attractive for specialists in violence to forgo predation in the present in exchange for larger payoff in the future. For this mechanism to sustain commitment, it is necessary that agents have a high enough discount factor, i.e., that they care enough about future payoffs. In this setup, competition among these agents can be detrimental to economic incentives as it can reduce their survival probability and hence the value of future output. Olson (1993) famously couched this view in terms of "roving bandits" whose precarious survival leads to full predation versus a "stationary bandit", an entrenched monarch who enjoys a long time horizon.[4]

Our paper is inspired by the fact that some real world institutional arrangements seem at odds with this Olsonian view and are predicated on the commonly held belief that diffusion of power is good. For example, in order to avoid collusion leading to abuses of their power, there are often strict protocols governing the manner in which the highest ranks of the military meet. Another famous historical example, which we deal with in more detail in section 3, comes from the Roman Republic, where ultimate power over the army was typically vested in two consuls with a view to keep a check on their power. This idea of checks and balances lies at the heart of our model, where the presence of several military units keeps each one in check creating a balance of power conducive to investments.

[3]It is interesting to note that the problem of commitment becomes salient only in economies where output depends on ex-ante investment. In a pure exchange economy the ability to commit is irrelevant since the equilibrium is likely to be Pareto efficient even with predation since there are no incentive effects. Piccione and Rubinstein (2007) present a model that makes this point formally.

[4]This argument is made formally in McGuire and Olson (1996) and Grossman and Noh (1990).

Our paper is related to Besley and Robinson (2009), who model the interaction between the military and civilian government when there is the possibility of the former seizing power through a coup. In their model, a key concern is the ability of the *government* to commit to pay the military, whereas our focus is on the commitment of the *military*. Furthermore, a major difference is that in our model agents within the military can collude to expropriate fullywithout incurring any costs.

More broadly, our research agenda is similar to Acemoglu and Robinson (2006), but with the major difference that commitment arises not from the power an agent with coercive power to tie his own hands but from the existence of other such agents who would stand to gain by punishing the deviant predator. This formulation enables us to attempt an answer to the question posed by Acemoglu (2003) about how agents with power can commit when the existence of their power to predate undermines any promises they make not to renege on their commitment whenever it is convenient. The insight that we formalise here is that commitment should not be seen as an additional strategy that may or may not be available to these agents as a result of exogenous institutional arrangements. Instead, we argue that commitment should be seen as a feature of an equilibrium arising from a game played between more than one specialists in violence.

The mechanism at play in our model is reminiscent of Dal Bó (2007), where a lobbyist can affect the outcome of a vote by a committee by offering members transfers which compensate voters for voting against their own preferences only when they are pivotal. Since this makes voting according to the wishes of the lobbyist a dominant strategy, the compensatory transfers are never paid out. The analogue idea in our model is that producers need to pay the specialists in violence only their payoff when they are the sole predator fighting against all others, i.e., when they are pivotal in predation, making this "bribe" small. On the other hand, our paper does not assume the existence of any kind of contract enforcement, which is required in Dal Bó (2007).

Acemoglu et al. (2009) is another paper which incorporates some aspects of our model, in that it features elimination (through voting, rather than fighting) of competitors that can potentially be a threat in future rounds of elimination. They analyse the conditions under which a military junta would degenerate into personal rule. They find that stable coalitions emerge only if the game between the members of the junta is infinitely repeated and the members have a high enough discount factor. In contrast in our model, we will find that it is possible to maintain a unique stable coalition of specialists in violence all of whom side with the producers, even in a one shot setting.

The paper is structured as follows. Section 2 discusses the baseline model with homogeneous agents and derives the comparative statics of the equilibrium. Section 2.4 extends the baseline model to allow heterogeneity in the strength of each specialist in violence. Section 3 is a case study of a historical institution, namely consulship during the Roman Republic, which supports the intuition of our argument. Section 4 discusses our empirical results and Section 5 provides concluding remarks.

2 Model

The economy is populated by an exogenously given number of producers and specialists in violence. We can think of a specialist in violence as an individual soldier, endowed with some strength, who unilaterally decides whether to predate or defend the producers. Alternately, it is also possible to think about a specialist in violence as a military leader who commands an independent military unit. This would be appropriate if we believe that the decision to predate or defend is taken by a military leader whose soldiers simply act on his orders. For different organisational forms within the military it may be appropriate to think of the specialist in violence as the general, the colonel, or an individual soldier depending on who makes the decision to predate or defend. At this stage we can remain agnostic about which one these is true.[5] For now all specialists in violence are assumed to be of equal strength. This assumption will be relaxed in section 2.4.

Producers operate a technology that requires some ex-ante investment in order to generate output. We assume that specialisation is complete, so that producers cannot defend themselves against specialists in violence, whilst the latter cannot control the former's investment decisions.[6] The interaction between these two groups is modelled as a game that unfolds as follow.

1. Producers make investments.
2. Output is realised and producers choose a fraction t of total output to offer to each specialist in violence.
3. Each specialist in violence independently chooses whether to predate or defend.
4. (a) If all specialists in violence choose to defend then each is paid the transfer t by the producers and the game ends.

   (b) If some specialists in violence choose to predate, there is a fight between predators and defenders, with defeated specialists in violence obtaining a payoff of 0.
5. (a) If the predators win, they expropriate all output and share it equally among themselves, since producers cannot fight back.

   (b) If the defenders win, they enter a subgame where they are the only specialists in violence playing the same game, and producers once again make transfers and the game restarts from stage 3.

[5]We discuss the implications of cross country variation in the military organisational forms when we take the model to the data in section 4.4 since this issue will be relevant in the empirics.

[6]Our paper is also related to the large literature on the co-existence of economic activity and conflict. Examples include Skaperdas (1992), Hirshleifer (1995), and Grossman and Kim (1995). See Garfinkel and Skaperdas (2007) for a survey of this literature. This literature models choices of agents when agents can invest to produce as well as increase their predatory capacity. Typically some investment occurs even though this is lower than the first best where agents can commit not to predate. This literature assumes that all agents work as producers as well as specialists in violence or that within a unit where agents specialise, the producers and specialists in violence have solved their commitment problem. The key innovation that distinguishes our paper from this literature is that we attempt to unpack how commitment between producers and specialists in violence can arise in the first place.

We first model the predation stage (the last three steps in the above timing) where specialists in violence make the decision of predating or defending. This decision depends on the transfers that are on offer from the producers. We then go back one step and derive the transfer that producers offer each specialist in violence.

2.1 Fighting

Suppose that at this stage, $p > 0$ specialists in violence have decided to predate and $q > 0$ have decided to defend. The probability that the predators win is

$$\frac{p}{\delta q + p} \ , \tag{1}$$

whereas the probability that the defenders win is

$$\frac{\delta q}{\delta q + p} \ . \tag{2}$$

These probabilities are similar to those given by contest success functions commonly used in the conflict literature, but differ from the latter since they depend solely on the number of agents on each side of the fight and not on the effort exerted by them. Therefore, fighting is completely costless in this formulation.[7] Note that this formulation also implies that if all specialists in violence decide to predate, they win costlessly with probability 1. The parameter δ indicates the degree to which the technology of fighting favours defenders.[8] We make the following assumption about δ and explain it in detail in the discussion following proposition (1).

Assumption 1. *Defending specialists in violence have a combat advantage over predators, so that* $\delta > 1$*.*

2.2 Predation vs defence

Since by this stage output is already realised, we will normalize it to 1, so that all payoffs are fractions of total output. Consider the decision of a specialist in violence to predate or defend when there are p predators and q defenders. If he joins the predators, their number increases to $p+1$ so that the probability of them winning is $\frac{p+1}{\delta q+p+1}$. Should they successfully predate, each predator obtains a share $\frac{1}{p+1}$ of output, so that the expected payoff from joining

[7]Introducing an exogenous cost to conflict in this framework is straightforward and only strengthens our result further, since the outside option to co-operation with producers becomes less attractive. On the other hand, introducing endogenous fighting costs when there are multiple specialists in violence is not quite as straightforward, since the usual contest function approach cannot be easily extended to the case with many players divided into two factions.

[8]Note that an alternative way of specifying these probabilities for predators and defenders is $\frac{(1-\gamma)p}{(1-\gamma)p+\gamma q}$ and $\frac{\gamma q}{(1-\gamma)p+gq}$ respectively. This is equivalent to our formulation. The assumption analogous to assumption 1 that would ensure a defensive advantage would be $\gamma > 1/2$.

p predators is

$$\Pi_q^{p+1} \stackrel{\text{def}}{=} \frac{1}{\delta q + p + 1} \ . \tag{3}$$

Should he instead join the defenders, their number rises to $q+1$ so that the probability of the defenders winning is $\frac{\delta(q+1)}{\delta(q+1)+p}$. After a successful defence, the remaining specialists in violence enter a subgame where they are offered transfers by producers and then choose to predate or defend. In that subgame, a specialist in violence has the option of predating and getting at least the payoff from being the sole predator.[9] Then, the expected payoff from joining q defenders is at least

$$\begin{aligned} \Delta_{q+1}^{p} &\stackrel{\text{def}}{=} \frac{\delta(q+1)}{\delta(q+1)+p}\Pi_q^1 \\ &= \frac{\delta(q+1)}{\delta(q+1)+p}\frac{1}{\delta q+1} \ . \end{aligned} \tag{4}$$

Given these payoffs from predation and defence, the following lemma shows that the latter dominates the former.

Lemma 1. *Iff $\delta > 1$, $\Delta_{q+1}^p \geq \Pi_q^{p+1}$ for all p and q, with strict inequality if $p > 0$.*

Proof. Comparing Δ_{q+1}^p and Π_q^{p+1} we have

$$\begin{aligned} \frac{\delta(q+1)}{(\delta(q+1)+p)(\delta q+1)} &\geq \frac{1}{\delta q+p+1} \\ \Leftrightarrow \frac{\delta q+p+1}{\delta q+1} &\geq 1+\frac{p}{\delta(q+1)} \\ \Leftrightarrow p\delta(q+1) &\geq p(\delta q+1) \end{aligned}$$

iff $\delta > 1$, with strict inequality if $p > 0$. □

This lemma shows that when there is a defensive advantage, a specialist in violence strictly prefers to join forces with defenders rather than the predators, if there are any of the latter. This is because the payoff from defending first and predating in the subsequent subgame, where some specialists in violence have been eliminated, is strictly greater than the payoff from predation. This means that in every subgame, there will be at most one predator.

2.3 Transfers

In the last stage, we saw that, from the point of view of an individual specialist in violence, it is always better to defend than to predate if some of the other specialists in violence are predating. But what about when all the other specialists in violence are also defending? In that case, the transfers that the producers offer will determine the choice of whether to predate or defend.

[9] Note that for fixed $p+q$, Π_q^{p+1} is increasing in p.

In our model, producers make a take-it-or-leave-it offer to the specialists in violence, who then independently decide their actions. Then, given that producers have all the bargaining power, it follows that specialists in violence are always pushed to their outside option.[10] This means that in every subgame after a successful defence, the producers' transfer is exactly equal to an individual specialist in violence's payoff from becoming the sole predator, so that Δ^p_{q+1} as defined in (4) is the actual defence payoff, not merely its lower bound. Since this makes specialists in violence indifferent between being sole predators and defenders we will make the following assumption.

Assumption 2. *Specialists in violence who are indifferent between predating and defending choose defence.*

We make defence the preferred option in case of indifference in order to rule out equilibria where only one specialist in violence predates and everyone (including the producers) gets exactly the same expected payoff as in the case where all specialists in violence accept the producers' offer.[11] However such equilibria are purely an artifact of the producers pushing the specialists in violence to their outside option, and disappear as soon as the latter have some bargaining power. Given this assumption, the preceding arguments lead to the following proposition.

Proposition 1. *The unique subgame-perfect Nash equilibrium of the game with $s+1$ specialists in violence consists of producers offering each specialist in violence a fraction*

$$t = \frac{1}{1+\delta s} \tag{5}$$

of total output, with all specialists in violence choosing not to predate.

Proof. The proof is established by induction on the number of specialists in violence. Firstly, note that when there is only one specialist in violence, his expected payoff from predation is one, since that is the probability with which he can expropriate all output. Then, producers can ensure that he does not predate by $t = 1$: this would make the specialist in violence indifferent between predation and non-predation, and by Assumption 1 the specialist in violence would not predate.

Next, suppose that we have already managed to prove that the proposition holds whenever the number of specialists in violence is less than or equal to some number s, and let us examine whether the proposition still holds if there are $s+1$ specialists in violence.

To analyse the predation and defence payoffs of an individual specialist in violence, suppose that $p \geq 1$ of the other specialists in violence have decided to predate and $q \leq s-1$ have

[10]The results are robust to changing the bargaining power of the producers and specialists in violence as long as the latter do not have all the bargaining power. With full bargaining power, specialists in violence make a take it or leave it offer leaving producers with nothing, and consequently the incentive for ex-ante investment is destroyed.

[11]The only difference with these equilibria is that unlike the unique equilibrium in proposition 1 with no predation, these contain a positive probability of predation. However the expected level of expropriation is equal to the total transfers in the no predation equilibrium and moreover the central message of the paper about decrease in expropriation through increased competition remains a feature of these equilibria.

decided to defend. Then his payoff from joining the p other predators is

$$\frac{p+1}{p+1+\delta q}\frac{1}{(p+1)} = \Pi_q^{p+1} \; . \tag{6}$$

On the other hand, the payoff from joining the q defenders is the expected value of the product of the probability that $q+1$ defenders win against p predators and of the payoff in the subgame where the defenders have won and there are only $q+1$ remaining specialists in violence. Since we are considering subgame-perfect equilibria we know that the payoff in that subgame will be the Nash equilibrium of that subgame. Furthermore, we assumed that the proposition holds in any game where the number of specialists in violence is at most s so that the Nash equilibrium payoff in a subgame where there are only $q+1$ specialist in violence is $\frac{1}{1+\delta q}$. The payoff from defence is then

$$\frac{\delta(q+1)}{p+\delta(q+1)}\frac{1}{1+\delta q} = \Delta_{q+1}^{p} \tag{7}$$

By Lemma 1, $\Delta_{q+1}^{p} > \Pi_q^{p+1}$ for all values of p, with strict inequality since $p \geq 1$. Therefore a specialist in violence always strictly prefers defence to predation if there is at least one other potential predator.

Suppose instead that, from the point of view of an individual specialist in violence all of the other specialists in violence are defenders. Then his payoff from predation is $\frac{1}{\delta s+1}$, whereas that from defence is simply the transfer t. By Assumption 2, producers can ensure that this specialist in violence does not predate by offering a transfer exactly equal to his predation payoff. Therefore, when there are $s+1$ specialists in violence, the only equilibrium is one where producers offer $t = \frac{1}{\delta s+1}$ and all specialists in violence do not predate. □

To reiterate, the intuition of this result is as follows. Although a larger number of predating specialists in violence increases the probability of a successful predation, the payoff conditional on success is weighed down by the decreased share each specialist in violence receives.[12] As a result it is more attractive for a specialist in violence to stave off predation with the expectation of the larger share he receives if the defenders win. Even a marginal defensive advantage ensures that it is a dominant strategy for all specialists in violence to defend. If all other s specialists in violence are defending the payoff of a lone specialist in violence who considers predation is $\Pi_s^1 = \frac{1}{1+\delta s}$. Hence when producers offer him this amount they make him indifferent between predation and defence and given Assumption 2, he defends.

It is now possible to see why $\delta > 1$ is foundational to our results. It ensures that potential predators always prefer to defend in order to eliminate competitors and guarantee themselves

[12] It is interesting to note that the reason why the increase in the numerator of the probability of successful predation is exactly offset by the reduction in the share of each specialist in violence is because p enters linearly in the numerator of the probability of successful predation defined in equation (1). Allowing for a more general functional form $\frac{f(p)}{\delta f(q)+f(p)}$ changes the results. Typically the uniqueness of equilibrium may no longer be available with a general $f(p)$ as multiple stable coalitions between specialists in violence may arise.

a higher payoff in the subsequent sub-game. There are several ways in which such a defensive advantage could arise. For instance it could arise out of the possibility of producers helping defending specialists in violence in the fight against the predating ones. Although in our model producers possess no combat ability, they could still provide help to defending specialists in violence through non-armed resistance in the form of intelligence gathering, sabotage or strikes, etc. Such activities would be of limited use to producers in protecting themselves from expropriation but could be a boost to a military force that can take advantage of them. However the induction structure of the proof implies that this way of thinking about the defensive advantage may be problematic. To see this note that producers should side with the defenders even in the case where the is only one defender. However in this case the producers should anticipate full predation following a successful defense and should consequently be indifferent to helping the defender.

Another way of motivating the presence of a defensive advantage is through the idea of social norms. In a society where the idea of protecting producers is firmly entrenched, and a specialist in violence is a military leader who commands a military unit, we would expect that troops would be at least marginally less likely to obey a command to predate. If this is the case, we may think of $\frac{1}{\delta}$ as the proportion of a predator's troops that stay loyal to him. This delivers the structure we need on the probability of victory for the two sides. It is interesting to note that it would be natural for such a social norm to arise in a society since all agents including specialists in violence are better off with it. In the absence of such a norm, producers would correctly anticipate full expropriation at the end of the period and will consequently invest nothing at the start. This in turn would reduce the payoff of the specialists in violence to zero. Hence the existence of such a norm turns out to be pareto efficient since it undergirds the ability of specialists in violence not to fully expropriate.

It is convenient to define the expropriation rate that the producers face, i.e., the fraction of total output that they transfer to the specialists in violence as

$$\tau \stackrel{\text{def}}{=} (s+1)t = \frac{s+1}{1+\delta s} = 1 - \frac{\delta - 1}{\delta + 1/s}. \tag{8}$$

Since $\delta > 1$, we can see that τ is decreasing in s. This shows that not only is the transfer paid to an individual specialist in violence decreasing in s, but that the sum of transfers is also decreasing in the number of specialists in violence. This is because, as the number of specialists in violence increases, the deviation payoff from predation becomes worse, which in turn decreases the equilibrium transfers they are paid.

Remark 1. *Expropriation is decreasing in the number of specialists in violence.*

This result captures the mechanism that this paper highlights. Total expropriation tends to decrease when power is diffuse. In particular, total expropriation decreases in the number of specialists in violence as the balance of power between them is such that unilateral predation becomes more and more unattractive. This result is interesting when contrasted with the Olsonian idea that decreasing the number of specialists in violence decreases their incentives to expropriate fully.

As we would expect, total expropriation is decreasing in the defensive advantage. The intuition for this is straightforward. As defence becomes easier, the expected payoff from predation decreases. Consequently specialists in violence are satisfied with a lower transfer and the degree of expropriation the producers face goes down.

The central message of the model is that competition among specialists in violence creates a balance of power that makes predation unattractive, leading to a commitment not to predate. The intuition behind this result is simple: the defensive advantage not only skews the probability of combat victory towards defence, but makes it profitable to defend first and predate later, rather than predate at the outset; defence is a way to eliminate competitors and thus guarantee a bigger payoff for oneself, making it the dominant strategy. The inability to commit to refrain from using co-operation with producers as a way to get rid of each other places specialists in violence in a Prisoner's Dilemma, which the producers can exploit to avoid full predation.

The inability of specialists in violence to commit is a crucial issue in our paper. In societies like ours, the ability to commit to agreements arises precisely from the existence of agents who can use their coercive power to punish those who renege on their commitments. But the commitment not to abuse their power is not available to the very agents who perform this enforcement function. Appealing to institutions to generate such commitment merely shifts the burden to the higher level specialists in violence who must support such institutions. This logic leads to an infinite regress where commitment at one level is sustained by commitment at a higher one. We have attempted to find a solution to this problem by using a somewhat different approach. In our model, what underlies the ability of specialists in violence to commit is not other institutions, but simply material forces that govern the success or failure of an attack aimed at expropriation, in other words material forces that shape the nature of the game that specialists in violence play.

2.4 Heterogeneity in strength

In this subsection we extend the model to allow specialists in violence to have differing strengths. This allows us to examine how expropriation changes in response to changes in the distribution of their strengths. In particular we find that total expropriation decreases as the distribution of strengths becomes more equal. This strengthens our main point about the positive impact of competition between specialists in violence.

Suppose that the specialists in violence are indexed by i, where $i = 1, ..., s$, and let each of them have strength x_i, which captures all factors that would contribute to increasing the probability of winning, such as their skill, the level of training, the quality of their equipment, or in case specialists in violence are military leaders, the number of troops they command. Now that strengths are different, it is natural to assume that victorious predators share output proportionally to their strengths. Thus a specialist in violence with strength x who successfully predated with others who have total strength P, would get a share of $\frac{x}{x+P}$ of total output.

We next prove the counterpart to Lemma 1, showing that defence is a dominant strategy, being strictly dominant if there is at least one predator already.

Lemma 2. *Iff $\delta > 1$, $x > 0$,*

$$\frac{\delta(Q+x)}{P+\delta(Q+x)} \frac{x}{x+\delta Q} \geq \frac{P+x}{P+x+\delta Q} \frac{x}{x+P} \tag{9}$$

with strict inequality if $P > 0$.

Proof. Inequality (9) is true iff

$$\frac{\delta(Q+x)}{P+\delta(Q+x)} \frac{1}{x+\delta Q} - \frac{1}{P+x+\delta Q} \geq 0 \tag{10}$$

$$\frac{(\delta-1)Px}{(P+\delta(Q+x)(x+\delta Q)(P+x+\delta Q)} \geq 0\,, \tag{11}$$

which holds with strict inequality iff $\delta > 1$. □

We can now prove the analogue of Proposition 1.

Proposition 2. *The unique subgame-perfect Nash equilibrium of the game where each specialist in violence has strength x_i is for producers to offer to each of them a transfer*

$$t_i^* = \frac{x_i}{x_i + \delta \sum_{j \neq i} x_j}\,, \tag{12}$$

and for all specialists in violence to not predate.

Proof. The proof is the same as that for Proposition 1 but using Lemma 2 to establish that defence is a dominant strategy whenever there is at least one predator, so that producers only need to offer to each specialist in violence their payoff from being the sole predator. □

An interesting feature of the equilibrium is that payoff of each specialist in violence depends not only on his strength, but also on that of all others. It is then natural to ask how the distribution of strengths affects the total expropriation that producers face. The following proposition shows that a more equal distribution leads to lower transfers.

Proposition 3. *Suppose that specialist in violence i and j have strengths $x_i > x_j$. Then reducing i's strength to $x_i - \varepsilon$ and increasing j's to $x_j + \varepsilon$, where $0 < \varepsilon < x_i - x_j$, will reduce total transfers.*

Proof. Since the redistribution of strength keeps the sum of i and j's strengths constant, the payoff to all other specialists in violence is unaffected. Therefore, it suffices to show that the transfers to i and j, namely $t_i^* + t_j^*$, will fall. Then we need to show that

$$\begin{aligned} &\frac{x_i}{x_i + \delta x_j + \delta \sum_{k \neq i,j} x_k} + \frac{x_j}{x_j + \delta x_i + \delta \sum_{k \neq i,j} x_k} \\ &\quad \geq \frac{x_i - \varepsilon}{x_i - \varepsilon + \delta(x_j + \varepsilon) + \delta \sum_{k \neq i,j} x_k} + \frac{x_j + \varepsilon}{x_j + \varepsilon + \delta(x_i - \varepsilon) + \delta \sum_{k \neq i,j} x_k} \\ &\quad = \frac{x_i - \varepsilon}{x_i + \delta x_j + (\delta - 1)\varepsilon + \delta \sum_{k \neq i,j} x_k} + \frac{x_j + \varepsilon}{x_j + \delta x_i - (\delta - 1)\varepsilon + \delta \sum_{k \neq i,j} x_k} . \end{aligned} \tag{13}$$

Letting $\sigma_i = x_i + \delta x_j + \delta \sum_{k \neq i,j} x_k$ and $\sigma_j = x_j + \delta x_i + \delta \sum_{k \neq i,j} x_k$, we need to show that

$$\frac{x_i}{\sigma_i} + \frac{x_j}{\sigma_j} \geq \frac{x_i - \varepsilon}{\sigma_i + (\delta - 1)\varepsilon} + \frac{x_j + \varepsilon}{\sigma_j - (\delta - 1)\varepsilon} \tag{14}$$

$$\Leftrightarrow \frac{x_i\sigma_j + x_j\sigma_i}{\sigma_i\sigma_j} \geq \frac{x_i\sigma_j + x_j\sigma_i - 2(\delta - 1)\varepsilon\big(x_i - x_j - \varepsilon\big)}{\sigma_i\sigma_j + (\delta - 1)^2\varepsilon\big(x_i - x_j - \varepsilon\big)} , \tag{15}$$

which is true if $\delta > 1$ and $0 < \varepsilon < x_i - x_j$. □

This proposition shows that a Dalton-transfer of strength from a stronger specialist in violence to a weaker one will reduce total transfers. As a consequence, a more equal distribution of strengths yields lower total transfers, with the minimum being achieved when all specialist in violence are homogeneous.

Remark 2. *Expropriation decreases with more equal distribution of strength among specialists in violence.*

This is in line with the intuitive idea that a balance of power as arising from power being equally spread out over a number of agents helps in preventing predation. A more even distribution of power yields more effective competition, strengthening our main point that competition is the force underlying the ability of specialists in violence to commit. Seen together remarks 1 and 2 reinforce the positive impact that competition among specialists in violence has on investment incentives in the economy.

3 Consuls in the Roman Republic

In this section we examine a particular institutional arrangement from ancient Rome that resonates quite cleanly with the mechanics of the model presented above. Consuls were the military and civil heads of the state during the Roman republic. The *fasti consulares*, a listing of the names and tenure of consuls, dates its first entry to 509 BC. The time period that fits our model most closely is from 509 BC when the office was established to around 89 BC.[13]

[13] A consul's power was superseded only in case of military emergency when a dictator was appointed. The instances of appointment of a dictator were few and short lived in this period. The exception to the rule of two consuls was the period of 426-367 BC which is known as 'the conflict of the orders' when consular power was often shared between three or more military tribunes. This does not affect our story since the results of our model are preserved as long as the number of specialists in violence is strictly greater than 1. We have relied on Hornblower and Spawforth, eds (2003) as a reference for the historical material used in this case study.

Although the office of the two consuls persisted well after the establishment of imperial rule in Rome, the concentration of the *imperium* in two consuls, that is their status as the joint heads of the executive, diminished gradually once Sulla assumed dictatorial control in 89 BC. This decline continued under the appointment of Julius Caesar as a perpetual dictator in 44 BC and thereafter under the establishment of imperial rule under Augustus in 27 BC.

Two consuls were elected every year and jointly held the *imperium*. Any decision made by a consul, such as a declaration of war, was subject to veto by the other consul. As the military heads, consuls were expected to lead Roman armies in the event of a war. In case both consuls were in the battlefield at the same time, they would share the command of the army, alternating as the head on a day to day basis. The election of the consuls was held by an assembly of soldiers known as the *centuria*.[14] The fact that consuls were elected from within the military and by the military confirms the primacy of their role as the heads of military. Indeed, their roles as the civilian heads can be seen as arising from the control they wielded over the military. It is therefore appropriate to think of them as analogous to the specialists in violence in the model.

The crucial assumption that we make in the model is $\delta > 1$. This ensures that when the specialists in violence are evenly divided on both sides in a battle, the side supporting the producers has at least a marginal advantage. This assumption seems valid in this setting. During this period in Roman history, a potential soldier needed to prove ownership of a certain amount of property to be eligible for recruitment in the military. This meant that the soldiers tended to have close family who were typically engaged in productive activities such as agriculture. Consequently, if the two consuls disagreed on an order to predate, the military was at least marginally more likely to obey the order for protection of the producers over an order for predation. Knowing this both consuls would have preferred protecting the producers leading to the Prisoner's Dilemma that we highlight. It is interesting to note that the property requirement for recruitment into the army was finally relaxed in 107 BC. This was followed closely by the transition of the republic into a dictatorship first under Sulla in 89 BC followed later by Julius Caesar and eventually the establishment of a monarchy under Augustus in 27 BC.

This institutional arrangement points to the belief that two military heads would effectively balance each other out. Since together they enjoyed absolute power, there was nothing preventing them from colluding with each other, other than the architecture of the game itself. The possibility of collusion can arise either through infinite repetition of the one shot game or through the possibility of contracting. It is possible to identify the institutional features that precluded these. Yearly elections ensured a finite time horizon for the consuls. Consuls were barred from seeking re-elections immediately after serving a year in office. Usually a period

[14] The assembly had 193 voting units, each unit representing a century, that is a group of one hundred soldiers. The assembly was composed of 18 centuries of *equites* that is the cavalry, 170 centuries of *pedites* that is the infantry and 5 centuries of non-combatants such as the horn blowers, artisans, etc. The voting order was the *equites* first followed by the *pedites* and lastly the non-combatants. See Taylor (2003) for a detailed exposition of the voting procedure in the *centuria*.

of ten years was expected before they could seek the office again. This term limit preserved the one-shot nature of the game. Second, there was no possibility of contracting since there was no higher authority than the consuls that could enforce any such contract. It appears that the consuls were locked in a game where the unique equilibrium was that they did not predate.

4 Empirics

In this section we test the hypothesis in remark 1 of a negative relationship between the risk of expropriation and the number of specialists in violence.[15] The empirical results will simply show that remark 1 is consistent with the data; we do not attempt to estimate any structural parameters of the model.

4.1 Data

The empirical analysis is based on panel data from the World Military Expenditures and Arms Transfers dataset compiled by the US Department of State.[16] The data comprises 168 countries over an 11 year period from 1995 to 2005. This contains data on our main explanatory variable, the number of active troops, together with data on military and government expenditure in 2005 US dollars, which we use as controls.

The empirical analogue of the number of specialists in violence is the number of troops. This is appropriate if we believe that a soldier can unilaterally decide whether to defend producers or to predate. However if a soldier simply obeys the command of a military leader, then the ideal measure for the number of specialists in violence is the number of military leaders. Since we lack data on the number of military leaders, we will use the number of troops as the regressor for our empirical analysis. In section 4.4 we describe the assumptions under which this is a valid proxy for the case when specialists in violence are military leaders and not soldiers.

We measure our dependent variable, the risk of expropriation, using the Investment Profile component of the Country Risk measure compiled by Political Risk Services for their International Country Risk Guide (ICRG). The Investment Profile index in the ICRG dataset has been widely used as a measure of the risk of expropriation starting with Knack and Keefer (1995). As noted by Acemoglu et al. (2001), although the variable is designed to capture the risk of expropriation for foreign investment, the correlation with the risk of expropriation for domestic investment is likely to be high. This variable measures the risk of expropriation on a scale from 0 to 12, with a higher score indicating a lower risk. Descriptive statistics for this and all other variables we use are reported in table 1.

[15] Unfortunately we don't have the data to test remark 2 which shows that the risk of expropriation is lower when the power of specialists in violence is more equal.

[16] The data is available at http://www.state.gov/t/avc/rls/rpt/wmeat/2005/index.htm

4.2 Baseline results

We start with the following simple specification

$$y_{it} = \alpha_i + \beta_t + \gamma \ln \mathsf{AT}_{it} + X'_{it}\eta + \varepsilon_{it}\,, \tag{16}$$

where α_i and β_t are country and time fixed effects, AT_{it} is the number of active troops, and X_{it} is a vector of time-varying country-level controls that include per capita income, government and military spending, population, indices for the rule of law and levels of internal and external conflict.

Table 2 reports the results of this regression. We observe that the estimate of γ is close to zero and statistically insignificant in all specifications. However, we expect competition among specialists in violence to have a different effect at different levels of development, with the relationship being stronger at lower levels of economic and institutional development. To test this, we regress the following specification where we interact the number of troops with the level of development as measured by per capita income averaged over five years from 1990 to 1994:

$$y_{it} = \alpha_i + \beta_t + \gamma \ln \mathsf{AT}_{it} + \lambda \ln \mathsf{AT}_{it} \cdot \ln \overline{\mathrm{GDP}}_i \;\; + X'_{it}\eta + \varepsilon_{it}\,. \tag{17}$$

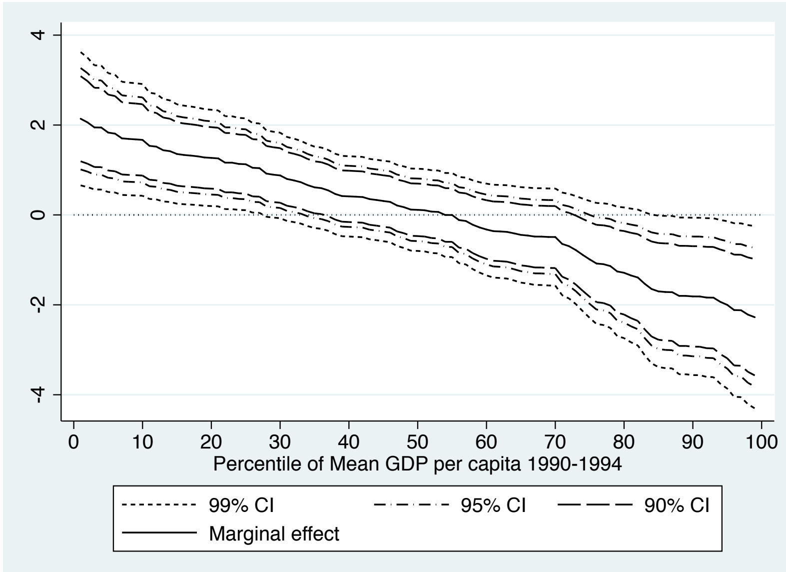
Table 3 reports the results of this regression. Although the estimate of γ is positive and significant, this in itself is not confirmation of our hypothesis because the interaction term implies that the marginal effect $\gamma + \lambda \cdot \ln \overline{\mathrm{GDP}}_i$ is a function of the level of average income. In particular, γ is the effect when log of the average per capita income is zero, whereas a negative λ indicates that this effect is declining in income, as expected. Figure 1 illustrates the marginal effect[17] at all income percentiles in the sample, with 90%, 95% and 99% confidence intervals computed using the method explained in appendix A.

The effect thresholds in each specification indicate the percentile of average income below which the estimated marginal effect $\hat{\gamma} + \hat{\lambda} \cdot \ln \overline{\mathrm{GDP}}_i$ is positive and significant at the 1%, 5%, and 10% level. For instance, the number 0.333 for the 5% effect threshold in column (6) indicates that this effect is significant at the 5% level for countries that are below the 33.3 percentile of the income distribution. Looking at these numbers across all specifications we can say that the competition effect seems to be significant for countries that are below the 30th percentile of the income distribution. To give a concrete example, in a country like Burkina Faso which is at the tenth percentile of the income distribution, a one percent increase in the number of troops would decrease the risk of expropriation by 1.76 points. We can see from figure 1 that this effect is significant at the 1% level. Since the index of risk of expropriation takes values between 0 and 12 this effect is economically significant.

Column (1) from table 3 reports the results of the regression where we only control for per-capita income. Since we control for both country and time fixed effects in all our specifications, any source of bias must arise from factors that vary over time within a country. One source

[17] Note that although the marginal is linear in Log Mean GDP per capita, it is not linear in the corresponding percentiles.

Figure 1: Marginal effect of Active Troops on Expropriation Risk against percentiles of Mean GDP per capita



of such variation is government spending. It is possible that government spending could lower the risk of expropriation through spending that strengthens property rights institutions. Independently, government spending could also lead to a higher number of troops. In an attempt to address this we control for government spending in column (2).

In our model we assume that producers make take it or leave it offers to the specialists in violence which implies that producers have all the bargaining power. If we relax this assumption, the risk of expropriation would vary with changes in the bargaining power. Our estimates may be biased if the variation in the bargaining power within a country is correlated with the number of troops. To address this concern, in column (4) we control for military expenditure and an index that measures the influence of military in politics with the hope that these capture changes in the bargaining power of the military.[18]

Another concern is that the risk of expropriation and the number of troops could be correlated with factors such as the presence of internal and external conflict. It is reasonable to assume that the presence of fewer troops may lead to an inadequate response to conflict and this could have an impact on the risk of expropriation. To address this concern we include two indices in column (5) that attempt to capture the level of internal and external conflict each year within a country.[19] Another related concern is that the presence of more troops could affect the risk of expropriation through better provision of law and order and lower crime. To address this we control for an index that captures the law and order situation in

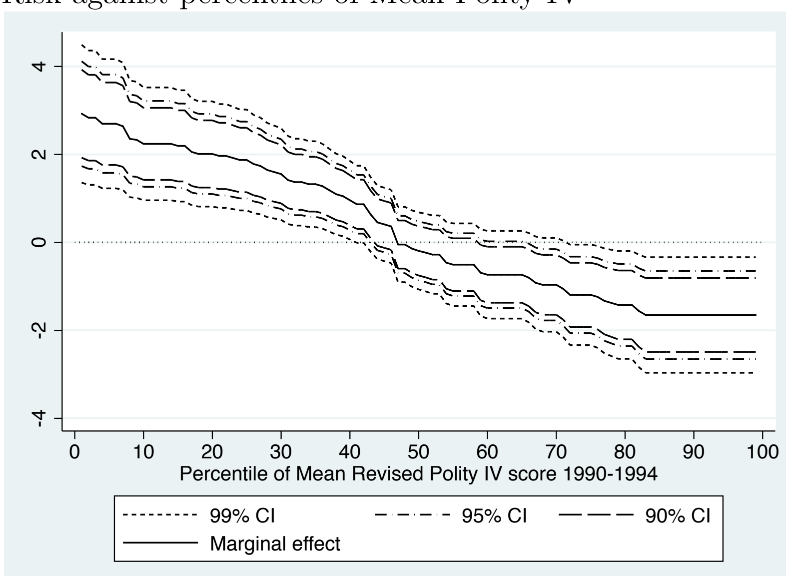
[18]Military in Politics is one of the subcomponents in the ICRG index that takes values between 0-6 with a higher score indicating a lower military presence in a country's politics.

[19]Internal and External Conflict are two of the subcomponents in the ICRG index each of which take values between 0-12 with a higher score indicating a lower level of internal or external conflict.

a country in a given year.[20] Our estimates of γ and λ remain stable and significant across these specifications. Similarly, the effect thresholds remain stable in all specifications.

Up to now we have used mean GDP per capita as the variable with respect to which the competition effect varies. We now interact institutional development rather than economic development with the number of troops to see its effect on the risk of expropriation. We use the mean of the Revised Polity IV variable (called POLITY2 in the Polity IV dataset[21]) for the sample period of 1990-1994. This variable captures the constraints that the executive face within a country. Table 4 reports the results. The sign on the coefficient stays negative and significant, indicating once again that our results apply to countries at lower levels of institutional development, i.e., countries where constraints on the executive are weak. Figure 2 plots the marginal effect for the regression in column (6). The thresholds reported in table 4 indicate, except in the case of column (1), that the competition effect seems to be significant at the 1% level for countries below the 40th percentile of the distribution of institutional quality.

Figure 2: Marginal effect of Active Troops on Expropriation Risk against percentiles of Mean Polity IV



4.3 Robustness checks

The results from tables 3 and 4 indicate that the effect of competition within the military is consistent with the data for countries at a lower level of institutional and economic development. GDP per capita and Polity IV averaged over 1990–1994 are our preferred proxies for a

[20] Law and Order is one of the subcomponents in the ICRG index which take values between 0-6 with a higher score indicating that there is lower crime.

[21] Our results are unchanged when we use POLITY instead of POLITY2 but the former is problematic in a panel data context such as ours since it does not correct for scores given to countries undergoing institutional transitions.

few reasons. Averaging over from 1990–1994, which is a period before our sample begins, is likely to ease concerns about the endogeneity of these measures. At the same time, since this time period is contiguous to our sample period (1995–2005), the measures would accurately capture the levels of economic and institutional development in this period. Moreover, averaging over a five year period implies that the resulting measures are unlikely to be affected by short run macroeconomic factors within a country. Finally, as we will show in section 4.4, since these measures do not vary over time within a country, it allows us to rule out certain sources of measurement error.

In the first four columns of table 5 we use other proxies for the level of development to see whether our results are robust to alternative formulations of the interaction term. Column (1) reports the results when we interact the number of troops with GDP per capita averaged over our sample period of 1995–2005. Similarly, column (2) reports the results when interact the number of troops with mean Polity IV averaged over 1995–2005. Column (3) reports the results from the regression where we interact the number of troops with GDP per capita, rather than its mean. Once again, the effect thresholds indicate that the competition is significant for a large proportion of countries. Finally, in column (4) we interact the number of troops with a dummy for whether the country is a member of the OECD. Note that since OECD membership is a categorical variable, the coefficient of active troops capture the competition effect for non-OECD countries, which we find to be significant.

So far we have used the Investment Profile component from the ICRG as our dependent variable. In columns (5) and (6) of table 5 we use the aggregate ICRG Country Risk index[22] to check whether our results are robust to alternative measures of the risk of expropriation. Although Investment Profile is the most accurate and appropriate measure of the risk of expropriation, the effect thresholds in the last two columns of table 5 show that our results still hold when we use the more general risk measure. Note that since Military in Politics, Internal and External Conflict, and Law and Order are subcomponents of this index we cannot control for these independently.

4.4 Proxying for Military Leaders

Our use of the number of troops as the empirical counterpart to specialists in violence in our model is based on the premise that each soldier unilaterally decides whether to predate or defend. If instead this decision is made by a military leader, and individual soldiers simply obey the command to predate or defend, then the use of this measure may be questionable. Who should be considered a military leader depends on the structure of the military within each country. In a military where the chain of command is weak, it may be appropriate to

[22]The ICRG Country Risk index is composed of twelve subcomponents. In addition to Investment Profile which measures the risk of expropriation, there is Government Stability, Socioeconomic Conditions, Internal Conflict, External Conflict, Corruption, Military in Politics, Religion in Politics, Law and Order, Ethnic Tensions, Democratic Accountability, and Bureaucracy Quality. The first six of these are scored between 0-12 and the last six between 0-6. As a result the aggregate index takes values between 0-100.

consider a lieutenant controlling a platoon consisting of a few soldiers as a military leader. On the other hand, in a military where the chain of command is firmly entrenched, a military leader could be a general controlling an army command consisting of thousands of soldiers. If the number of military leaders is the correct empirical analogue for the specialists in violence in our model then using the number of troops as our explanatory variable may be problematic. In what follows we show that the number of troops is still a valid proxy under two assumptions; first, the ratio of military leaders to active troops remains constant within a country, but may vary across countries, over the sample period; second, all military leaders within a country have the same number of troops, although this number could vary across countries.

To see that the proxy works under these assumptions, let θ_i be the time invariant ratio of military leaders to active troops in country i. Since each military leader within a country is assumed to have the same number of troops, the number of military leaders in country i at time t is simply $\theta_i \cdot \mathsf{AT}_{it}$. Using this as the regressor, the regression specification we proposed in equation (17) modifies to

$$\begin{aligned} y_{it} &= \beta_t + \alpha_i + \gamma \ln(\theta_i \cdot \mathsf{AT}_{it}) + \lambda \ln(\theta_i \cdot \mathsf{AT}_{it}) \cdot \ln \overline{\text{GDP}}_i + X_{it}'\eta + \varepsilon_{it}. \\ &= \beta_t + \alpha_i + (\gamma + \lambda \ln \overline{\text{GDP}}_i) \ln \theta_i + \gamma \ln \mathsf{AT}_{it} + \lambda \ln \mathsf{AT}_{it} \cdot \ln \overline{\text{GDP}}_i + X_{it}'\eta + \varepsilon_{it}. \end{aligned}$$

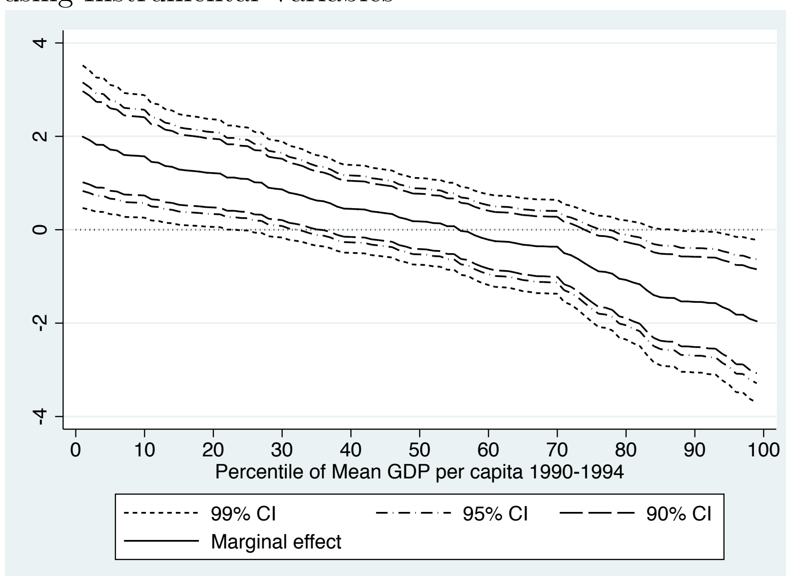
Since the term $(\gamma + \lambda \ln \overline{\text{GDP}}_i) \ln \theta_i$ varies across countries but is constant over time within a country, it is absorbed by the country fixed effects and the estimates for γ and λ, when we use the log of active troops as our regressor, are consistent. Note that this argument works because we use average GDP as our proxy for the level of economic development, since average GDP does not vary over time within a country. This argument applies *mutatis mutandis* to the regressions where we use the average of Polity IV as our proxy for the level of institutional development. If either of these two assumptions are violated then this may cause our explanatory variables to be measured incorrectly causing the estimates to be biased. The presence of the interaction term implies that the measurement error that is induced is not of the classical variety. Consequently the direction of bias is difficult to predict analytically.

4.5 Endogeneity

A concern about the results we have presented so far is that the risk of expropriation is simultaneously determined along with our explanatory variables. In particular we would expect that contemporaneous values of per capita income, which is one of our controls, are affected by the risk of expropriation. The use of mean levels of development from 1990 to 1994, i.e., before our sample period, mitigates this concern. However, since the controls remain necessarily contemporaneous, their endogeneity could still be an issue. Although we attempt to address this concern in this section, we should point out that it is difficult to make a water-tight case for the variation in our explanatory variables being completely exogenous. Consequently our empirical results should be seen more as robust correlations that indicate that the mechanism we model is consistent with the data.

To address the concern that contemporaneous values of our explanatory variables are likely to be simultaneously determined with the risk of expropriation, we run the specification in equation (17) where each regressor is instrumented by the lags of all. Table 6 reports the results. As shown by the Cragg-Donald F-statistic reported in table 6, the first stage is significant at the 0.1% level for all specifications. We can see from effect thresholds that the results of the instrumental variable regression follow the same pattern as before. The marginal effect and its confidence intervals from column (6) presented in figure 3 confirm this.

Figure 3: Marginal effect of Active Troops on Expropriation Risk against percentiles of Mean GDP per capita estimated using Instrumental Variables



5 Conclusion

We have presented a model that attempts to explain how agents with control over coercive power can commit not to expropriate from producers. The insight that we formalise here is that this form of commitment should not be seen as an additional strategy that may or may not be available to specialists in violence as a result of exogenous institutional arrangements. Instead, we have argued that commitment should be seen as a feature of an equilibrium arising in a game played between more than one specialist in violence. The model predicts that the equilibrium rate of expropriation is decreasing in the number of specialists in violence and also as the distribution of their strengths becomes less heterogeneous. These predictions are in line with the notion that creating a balance between more than one centers of power leads to checks and balances against abuse of power. This model supplies an alternative to the Olsonian view that concentration of power in the hands of a few leads to reduction in expropriation.

We have attempted to test the model's prediction using a cross-country panel dataset. We find that increasing the number of specialists in violence is associated with a reduction in the risk of expropriation, but only in developing countries. This is consistent with the idea that the link between expropriation risk and the power of agents who control the means of coercion is more salient at lower levels of institutional and economic development. Our results suggest that in addition to the long run component of institutions there may also be a short run component that fluctuates with the changes in the degree of competition among agents who underpin these institutions through the control coercive power.

References

Acemoglu, Daron, "Why not a Political Coase Theorem? Social Conflict, Commitment, and Politics," *Journal of Comparative Economics*, 2003, *31.*

_ **and James Robinson**, *Economic Origins of Dictatorship and Democracy*, MIT press, 2006.

_ **, Georgy Egorov, and Konstantin Sonin**, "Do Juntas Lead to Personal Rule?," *American Economic Review: Papers and Proceedings*, 2009, *99* (2), 298–303.

_ **, Simon Johnson, and James A. Robinson**, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 2001, *91* (5).

Besley, Timothy and James A. Robinson, "Quis Custodiet Ipsos Custodes? Civilian Control over the Military," 2009. unpublished.

_ **and Maitreesh Ghatak**, *Property Rights and Economic Development*, North-Holland, 2010.

Bó, Ernesto Dal, "Bribing Voters," *American Journal of Political Science*, 2007, *51* (4), 789–803.

Djankov, Simeon, Rafael La Porta, Florencio Lopez-De-Silanes, and Andrei Shleifer, "Courts," *Quarterly Journal of Economics*, 2003, *118* (2).

Engerman, Stanley L. and Kenneth L. Sokoloff, "History lessons: Institutions, Factors Endowments, and Paths of Development in the New World," *Journal of Economic Perspectives*, 2000, *14* (3).

Garfinkel, Michelle and Stergios Skaperdas, *Economics of Conflict: An Overview*, Handbook of Defense Economics, 2007.

Grossman, Herschel I. and Minseong Kim, “Swords or Plowshares? A Theory of the Security of Claims to Property,” *Journal of Political Economy*, Dec. 1995, *103* (6), 1275–1288.

_ **and Suk Jae Noh**, “A Theory of Kleptocracy with Probabilitic Survival and Reputation,” *Economics and Politics*, 1990, *2* (2).

Hirshleifer, Jack, “Anarchy and its Breakdown,” *Journal of Political Economy*, Feb. 1995, *103* (1), 26–52.

Hornblower, Simon and Anthony Spawforth, eds, *The Oxford Classical Dictionary*, 3 ed., Oxford University Press, 2003.

Knack, Stephen and Philip Keefer, “Institutions and Economics Performance: Cross-Country Tests Using Alternative Measures,” *Economics and Politics*, 1995, *7* (3).

McGuire, MC and M Olson, “The economics of autocracy and majority rule: The invisible hand and the use of force,” *Journal of Economic Literature*, May 1996, *34* (1), 72–96.

North, Douglass C, John Joseph Wallis, and Barry R. Weingast, *Violence and Social Orders*, Cambridge University Press, 2009.

Olson, Mancur, “Dictatorship, Democracy, and Development,” *American Political Science Review*, Sep. 1993, *87* (3), 567–576.

Piccione, Michele and Ariel Rubinstein, “Equilibrium in the Jungle,” *Economic Journal*, July 2007, *117* (522), 883–896.

Skaperdas, Stergios, “Cooperation, Conflict, and Power in the Absence of Property Rights,” *American Economic Review*, Sep. 1992, *82* (4), 720–739.

Taylor, Lily Ross, *Roman Voting Assemblies: From Hannibalic War to the Dictatorship of Caesar*, The University of Michigan Press, 2003.

A Calculation of Marginal Effects

The estimated marginal effect of $\ln \mathsf{AT}$ on the risk of expropriation in our main specification (17) is given by

$$\phi(z) \stackrel{\text{def}}{=} \hat{\gamma} + \hat{\lambda} x \,, \tag{18}$$

where $\hat{\gamma}$ and $\hat{\lambda}$ are the estimators of γ and λ, respectively, and x is the level of the variable that is interacted with $\ln \mathsf{AT}$, such as Mean GDP per capita (Table 3) or Mean Polity IV (Table 4). Let X be the matrix of all regressors, including x. Then, the variance of ϕ conditional on X is

$$\operatorname{Var}(\phi(x)|X) = \operatorname{Var}(\hat{\gamma}|X) + 2x \operatorname{Cov}(\hat{\gamma}, \hat{\lambda}|X) + x^2 \operatorname{Var}(\hat{\lambda}|X) \,, \tag{19}$$

so that the asymptotic confidence interval for $\phi(x)$ is given by

$$\hat{\gamma} + \hat{\lambda} x \pm z \sqrt{\hat{\sigma}_\gamma^2 + 2x\hat{\sigma}_{\gamma,\lambda} + x^2 \hat{\sigma}_\lambda^2} \,, \tag{20}$$

where z is the appropriate normal critical value, and $\hat{\sigma}_\gamma^2$, $\hat{\sigma}_{\gamma,\lambda}$ and $\hat{\sigma}_\lambda^2$ are the estimates of $\operatorname{Var}(\hat{\gamma}|X)$, $\operatorname{Cov}(\hat{\gamma}, \hat{\lambda}|X)$ and $\operatorname{Var}(\hat{\lambda}|X)$, respectively. Figures 1, 2 and 3 are then drawn by computing these confidence intervals against percentiles of x using the critical values of z at the 10%, 5% and 1% significance levels.

In order to find the value of x at which the lower bound of the confidence interval is zero, we set equation (20) equal to zero and solve

$$\hat{\gamma} + \hat{\lambda} x - z \sqrt{\hat{\sigma}_\gamma^2 + 2x\hat{\sigma}_{\gamma,\lambda} + x^2 \hat{\sigma}_\lambda^2} = 0 \tag{21}$$

$$\iff \big(\hat{\gamma} + \hat{\lambda} x\big)^2 - z^2 \big(\hat{\sigma}_\gamma^2 + 2x\hat{\sigma}_{\gamma,\lambda} + x^2 \hat{\sigma}_\lambda^2\big) = 0 \tag{22}$$

$$\iff \big(\hat{\lambda}^2 - z^2 \hat{\sigma}_\lambda^2\big) x^2 + 2\big(\hat{\gamma}\hat{\lambda} - z^2 \hat{\sigma}_{\gamma,\lambda}\big) x + \big(\hat{\gamma}^2 - z^2 \hat{\sigma}_\gamma^2\big) = 0 \tag{23}$$

for x, being careful to pick the appropriate solution through inspection of the graph of marginal effects with respect to x. The effect thresholds reported in Tables 3 to 6 are then computed by finding the percentiles of x corresponding to the solutions for the 10%, 5% and 1% significance levels.

B Tables

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
ICRG Investment Profile	7.797	2.402	0	12	1443
ICRG Country Risk	67.337	13.641	22.458	96.083	1443
Log Active Troops	3.511	1.696	0	7.983	1754
Log GDP per capita in 2005 US dollars	7.797	1.651	4.413	11.296	1787
Log Population	2.142	1.639	-2.303	7.178	1815
Log Government Spending in 2005 US dollars	8.579	2.236	3.367	14.79	1745
Log Military Spending in 2005 US dollar	6.088	2.337	0	13.128	1735
ICRG Military in Politics	10.200	1.639	2.125	12	1443
ICRG Internal Conflict	3.828	1.738	0	6	1443
ICRG External Conflict	3.809	1.820	0	6	1443
ICRG Law and Order	4.179	1.367	0	6	1443
Revised Combined Polity IV score (POLITY2)	2.843	6.704	-10	10	1698

POLITY2 and ICRG variables are indices

Table 2: No interaction with level of development

	(1)	(2)	(3)	(4)	(5)	(6)
Log Active Troops	−0.196	0.221	0.133	0.135	0.106	0.224
	(0.260)	(0.403)	(0.404)	(0.379)	(0.380)	(0.402)
Log GDP p.c.	2.838***	4.153***	3.992***	4.019***	4.005***	3.766***
	(0.687)	(0.706)	(0.673)	(0.651)	(0.651)	(0.723)
Log Gov. Spending		−0.967**	−1.110***	−1.210***	−1.224***	−1.122***
		(0.376)	(0.389)	(0.378)	(0.376)	(0.383)
Log Mil. Spending			0.363	0.326	0.335	0.315
			(0.263)	(0.259)	(0.262)	(0.262)
Military in Politics			0.0623	0.0352	0.0317	0.0385
			(0.0715)	(0.0687)	(0.0696)	(0.0698)
Internal Conflict				0.214**	0.207**	0.205**
				(0.0915)	(0.0956)	(0.0950)
External Conflict				0.0625	0.0616	0.0660
				(0.135)	(0.135)	(0.135)
Law and Order					0.0707	0.0915
					(0.110)	(0.107)
Log Population						−1.648
						(1.776)
Constant	−16.28***	−19.66***	−19.81***	−19.67***	−19.64***	−15.26*
	(5.512)	(6.480)	(6.328)	(5.825)	(5.814)	(7.933)
N	1391	1357	1353	1353	1353	1353
R^2	0.528	0.554	0.557	0.565	0.565	0.566

Notes: Dependent variable is Investment Profile from ICRG. Standard errors clustered at the country level are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include country and year fixed effects.

Table 3: Interacting with Mean GDP per capita 1990–1994

	(1)	(2)	(3)	(4)	(5)	(6)
Log Active Troops	6.091***	6.173***	5.986***	5.911***	5.932***	5.823***
	(1.453)	(1.416)	(1.519)	(1.468)	(1.464)	(1.474)
Log Mean GDP p.c. 1990–1994	−0.832***	−0.825***	−0.805***	−0.795***	−0.801***	−0.773***
× Log Active Troops	(0.203)	(0.195)	(0.206)	(0.202)	(0.202)	(0.204)
Log GDP p.c.	2.762***	3.754***	3.679***	3.695***	3.678***	3.451***
	(0.728)	(0.676)	(0.657)	(0.661)	(0.666)	(0.736)
Log Gov. Spending		−0.961**	−1.049***	−1.134***	−1.151***	−1.073***
		(0.380)	(0.396)	(0.389)	(0.387)	(0.391)
Log Mil. Spending			0.240	0.207	0.218	0.210
			(0.265)	(0.270)	(0.272)	(0.270)
Military in Politics			0.0124	−0.0126	−0.0159	−0.0116
			(0.0649)	(0.0631)	(0.0640)	(0.0649)
Internal Conflict				0.220**	0.215**	0.213**
				(0.0948)	(0.0991)	(0.0988)
External Conflict				−0.000118	0.00122	0.00220
				(0.139)	(0.140)	(0.140)
Law and Order					0.0653	0.0819
					(0.114)	(0.113)
Log Population						−1.363
						(1.837)
Constant	−14.96**	−14.73**	−14.92**	−14.67***	−14.57***	−10.66
	(6.130)	(5.746)	(5.749)	(5.512)	(5.545)	(8.084)
N	1281	1267	1263	1263	1263	1263
R^2	0.556	0.575	0.576	0.583	0.583	0.584
Effect threshold at 10%	0.347	0.374	0.347	0.360	0.347	0.360
Effect threshold at 5%	0.326	0.347	0.326	0.333	0.326	0.333
Effect threshold at 1%	0.272	0.306	0.258	0.279	0.272	0.279

Notes: Dependent variable is Investment Profile from ICRG. Standard errors clustered at the country level are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include country and year fixed effects. The effect threshold is the percentile of Mean GDP per capita 1990–1994 below which the marginal effect of Active Troops is positive and significant at the corresponding significance level.

Table 4: Interacting with Mean Polity IV 1990–1994

	(1)	(2)	(3)	(4)	(5)	(6)
Log Active Troops	−0.507	0.769***	0.668**	0.634**	0.595**	0.638*
	(0.322)	(0.288)	(0.295)	(0.288)	(0.294)	(0.329)
Mean Polity IV 1990–1994	−0.0715*	−0.252***	−0.248***	−0.232***	−0.237***	−0.229***
× Log Active Troops	(0.0429)	(0.0476)	(0.0478)	(0.0457)	(0.0455)	(0.0455)
Log GDP p.c.	2.688***	4.199***	4.043***	4.093***	4.066***	3.956***
	(0.718)	(0.653)	(0.624)	(0.612)	(0.614)	(0.693)
Log Gov. Spending		−1.070***	−1.212***	−1.314***	−1.343***	−1.294***
		(0.389)	(0.393)	(0.382)	(0.377)	(0.397)
Log Mil. Spending			0.364	0.336	0.353	0.347
			(0.250)	(0.248)	(0.251)	(0.252)
Military in Politics			0.0639	0.0364	0.0302	0.0346
			(0.0695)	(0.0679)	(0.0688)	(0.0695)
Internal Conflict				0.197**	0.185*	0.186*
				(0.0899)	(0.0958)	(0.0957)
External Conflict				0.0505	0.0477	0.0493
				(0.133)	(0.133)	(0.133)
Law and Order					0.132	0.142
					(0.109)	(0.105)
Log Population						−0.895
						(1.865)
Constant	−13.02**	−18.07***	−18.29***	−18.29***	−18.19***	−15.88**
	(6.000)	(5.265)	(5.181)	(4.941)	(4.922)	(7.457)
N	1336	1302	1298	1298	1298	1298
R^2	0.539	0.584	0.587	0.593	0.594	0.595
Effect threshold at 10%		0.462	0.449	0.436	0.436	0.436
Effect threshold at 5%		0.449	0.436	0.436	0.436	0.423
Effect threshold at 1%		0.436	0.423	0.423	0.423	0.404

Notes: Dependent variable is Investment Profile from ICRG. Standard errors clustered at the country level are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include country and year fixed effects. The effect threshold is the percentile of Mean Polity IV 1990–1994 below which the marginal effect of Active Troops is positive and significant at the corresponding significance level.

Table 5: Robustness checks

Dependent variable	Inv. Profile	Inv. Profile	Inv. Profile	Inv. Profile	Country Risk	Country Risk
Interacted variable	Log Mean GDP p.c. 1995–2005	Mean Polity IV 1995-2005	Log GDP p.c.	OECD	Log Mean GDP p.c. 1990–1994	Mean Polity IV 1990–1994
Log Active Troops	5.330***	1.108**	4.307***	0.931***	15.09**	4.057***
	(1.086)	(0.493)	(0.933)	(0.351)	(6.749)	(1.303)
Interaction estimates	−0.685***	−0.229***	−0.559***	−3.016***	−1.664**	−0.693***
	(0.154)	(0.0670)	(0.135)	(0.648)	(0.818)	(0.204)
Log GDP p.c.	3.765***	4.071***	5.670***	3.849***	12.06***	13.39***
	(0.693)	(0.701)	(0.936)	(0.698)	(3.091)	(3.029)
Log Population	−0.604	−1.386	−0.937	−0.384	8.121	15.65**
	(1.734)	(1.845)	(1.796)	(1.781)	(5.141)	(6.072)
Log Gov. Spending	−1.168***	−1.228***	−1.102***	−1.102***	−0.651	−0.602
	(0.365)	(0.398)	(0.358)	(0.367)	(1.824)	(1.738)
Log Mil. Spending	0.196	0.366	0.256	0.253	0.853	0.914
	(0.250)	(0.257)	(0.250)	(0.251)	(1.335)	(1.189)
Military in Politics	0.0502	0.0406	0.0468	0.0378		
	(0.0654)	(0.0659)	(0.0667)	(0.0678)		
Internal Conflict	0.197**	0.172*	0.175*	0.185**		
	(0.0932)	(0.0940)	(0.0915)	(0.0934)		
External Conflict	0.0271	0.0624	0.0414	0.0704		
	(0.130)	(0.130)	(0.128)	(0.129)		
Law and Order	0.110	0.145	0.121	0.115		
	(0.109)	(0.106)	(0.109)	(0.110)		
Constant	−14.67*	−17.38**	−30.29***	−18.16**	−57.40*	−86.43***
	(7.486)	(7.760)	(8.958)	(7.574)	(29.72)	(30.71)
N	1353	1309	1353	1353	1263	1298
R^2	0.582	0.590	0.582	0.583	0.153	0.179
Effect threshold at 10%	0.393	0.404	0.333		0.585	0.487
Effect threshold at 5%	0.368	0.372	0.303		0.537	0.462
Effect threshold at 1%	0.294	0.308	0.237			0.462

Notes: Standard errors clustered at the country level are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include country and year fixed effects. The interacted variable is interacted with Log Active Troops. The effect threshold is the percentile of the interacted variable below which the marginal effect of Active Troops is positive and significant at the corresponding significance level.

Table 6: Instrumental variables

	(1)	(2)	(3)	(4)	(5)	(6)
Log Active Troops	5.398***	5.812***	5.248***	5.393***	5.394***	5.291***
	(1.293)	(1.301)	(1.381)	(1.385)	(1.385)	(1.391)
Log Mean GDP p.c. 1990–1994	−0.766***	−0.757***	−0.699***	−0.719***	−0.719***	−0.692***
× Log Active Troops	(0.171)	(0.172)	(0.179)	(0.179)	(0.180)	(0.183)
Log GDP p.c.	2.916***	4.691***	4.415***	4.573***	4.579***	4.432***
	(0.547)	(0.649)	(0.700)	(0.710)	(0.716)	(0.744)
Log Gov. Spending		−2.248***	−2.372***	−2.396***	−2.394***	−2.324***
		(0.439)	(0.453)	(0.457)	(0.458)	(0.468)
Log Mil. Spending			0.544	0.466	0.463	0.449
			(0.448)	(0.451)	(0.455)	(0.455)
Military in Politics			0.0287	0.0293	0.0298	0.0351
			(0.0686)	(0.0707)	(0.0712)	(0.0715)
Internal Conflict				0.0912	0.0921	0.0924
				(0.0893)	(0.0907)	(0.0906)
External Conflict				−0.113	−0.114	−0.113
				(0.110)	(0.110)	(0.110)
Law and Order					−0.00686	0.0103
					(0.120)	(0.123)
Log Population						−0.962
						(1.355)
N	1144	1142	1139	1139	1139	1139
R^2	0.484	0.478	0.480	0.483	0.482	0.484
First stage F-statistic	104.7	55.10	30.64	30.25	29.39	29.36
Effect threshold at 10%	0.279	0.408	0.333	0.347	0.333	0.360
Effect threshold at 5%	0.258	0.374	0.306	0.306	0.306	0.326
Effect threshold at 1%	0.136	0.326	0.204	0.217	0.211	0.231

Notes: Dependent variable is Investment Profile from ICRG. Standard errors are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include country and year fixed effects. The effect threshold is the percentile of Mean GDP per capita 1990–1994 below which the marginal effect of Active Troops is positive and significant at the corresponding significance level. Each regressor has been instrumented by the lags of Log Active Troops, Log Active Troops × Log Mean GDP p.c. 1990–1994, Log GDP p.c., Log Gov. Spending, Log Mil. Spending, Military in Politics, Internal Conflict, External Conflict, Law and Order and Log Population. The first-stage F-statistic reports the Cragg-Donald Wald F-statistic for weak identification.