Custodes Invicem Custodiunt: Commitment through Competition

Madhav S. Aney* & Giovanni Ko†

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Abstract

How can specialists in violence, such as the military or the police, commit not to expropriate from producers? In this paper we propose competition between these agents as one of the mechanisms that can deter predation. In our model, even if specialists in violence 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 other specialists in violence, reducing competition and leading to higher future payoffs. Hence, producers can offer transfers to specialists in violence that make defense a dominant strategy, resulting in an equilibrium without predation. We therefore show that internal competition among specialists in violence is enough to keep predatory behaviour at bay and sustain economic incentives even in the absence of threats external to themselves. Our answer to the question of "who guards the guards" is that "the guards guard each other" (*custodes invicem custodiunt*). We test the model using a panel of countries and find that the competition effect we highlight is consistent with the data for countries at low levels of development.

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

*School of Economics, Singapore Management University

†Department of Economics, London School of Economics. We would like to thank Rashmi Barua, Tim Besley, Geoffrey Brennan, Maitreesh Ghatak, Gerard Padró-i-Miquel, Enrico Spolaore and Tianxi Wang, for their helpful comments and suggestions.

can use coercive power to punish those who violate them. But how can these agents commit not to abuse this power for their own gain? This commitment is important in modern economies where the possibility of ex-post expropriation would seriously undermine incentives for ex-ante investments leading to bad economic outcomes[1], but where the means of coercive power are solely in the hands of specialized agents whom we call *specialists in violence* following the terminology of North et al. (2009). Thus, modern societies have agents whose job it is to guard property rights and contractual agreements, but "who guards the guards themselves? (*quis custodiet ipsos custodes?*)", as the famous question goes.

Our answer to this question is that "the guards guard each other" (*custodes invicem custodiunt*), that is, competition between specialists in violence, and in particular, their inability to commit not to turn against one another, keeps predatory behaviour at bay. In our model, even if specialists in violence 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 other specialists in violence, reducing competition and leading to higher future payoffs. Producers can therefore engineer a Prisoner's dilemma that exploits the desire of specialists in violence 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 producers help the defending general fight against the predating one so that the 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 is predating, the payoff from defense consists of output times the probability of winning, which is greater than a half due to the producers' help. On the other hand, the payoff from colluding with the predating general is only half of output since they share output equally. Then producers can 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

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

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, we show that the proportion of output that they obtain in the form of transfers is decreasing in their number. 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 between 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 the incentives to abuse it.

Finally using only within country variation over time we find that the positive effect of competition among specialists in violence on expropriation risk that we highlight in the model holds true for countries at lower levels of development but attenuates at higher levels of development. This is consistent with the idea that problem of civilian control over specialists in violence is a salient issue for countries at a less advanced stage of institutional development.

Our paper 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 from those who don't. The main thrust of the existing literature is that commitment arises as a consequence of the repeated nature of the game that producers and specialists in violence play. In a one-shot game producers anticipate predation at the end of the period and this leads to no investment in equilibrium.[2] 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 between specialists in violence can be detrimental to 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

[2]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.

time horizon.[3]

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 often-voiced view 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 later, 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 specialists in violence keeps each one in check creating a balance of power conducive to investments.

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 specialists in violence can collude to expropriate fully without 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 of a specialist in violence to tie his own hands but from the existence of other specialists in violence 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 specialists in violence 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 specialists in violence 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 specialist in violence.

Our paper is also related to the large literature on the co-existence of economic activity and conflict.[4] This literature models choices of agents when agents can invest to produce as well as increase their predatory

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

[4] Examples include Skaperdas (1992), Hirshleifer (1995), and Grossman and Kim (1995). See Garfinkel and Skaperdas (2007) for a survey of this literature.

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.

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 improve future conditions, but their objective is to analyse what are stable configurations of power where no one can eliminate anyone else. In their context, in our model, any collection of specialists in violence is stable, since any predatory activity (including attacking others) will be punished by the other specialists who obtain the help of producers.

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 the historical instution of 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. Producers operate a technology that requires some ex-ante investment in order to generate output. Specialists in violence, henceforth abbreviated to SIVs, can fight against each other and/or expropriate the producers' output. Specialisation is complete, so that producers cannot defend themselves against SIVs, whilst the latter cannot control the former's investment decisions. The interaction between these two groups is modelled as a game that unfolds as follow.

1. Producers make investments, whilst SIVs wait.
2. Output is realised and producers choose a fraction t of total output to offer to each of the SIVs.
3. Each SIV independently chooses whether to predate or defend.
4. (a) If all SIVs choose to defend then each is paid the transfer t by the producers and the game ends.
   (b) If some SIVs choose to predate, there is a fight between predators and defenders, with defeated SIVs 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 SIVs playing the same game, and producers once again make transfers and the game restarts from stage 3.

We first model the predation stage (the last three steps in the above timing) where SIVs 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 SIV. After this, we model the stage where producers make ex-ante investments.

2.1 Fighting

Suppose that at this stage, $p > 0$ SIVs have decided to predate and $q > 0$ SIVs 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.[5]

The parameter δ indicates the degree by which the technology of fighting favours defenders and we will make use of the following assumption regarding it.

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

This assumption is foundational to our results. We can think of the defensive advantage as arising out of the possibility that producers help defending SIVs in the fight against the predating ones. Although in our model producers possess no combat ability, they could still provide help to defending SIVs 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. Alternatively we can also think of the defensive advantage as arising from the possibility that troops of a SIV are more likely to obey a command to protect the producers rather than a command to predate. Although a defensive advantage is crucial in our model, it should be noted that this advantage can be arbitrarily small.[6]

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 a SIV's decision 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 SIV would obtain a share $\frac{1}{p+1}$ of output, so that the expected payoff from joining p predators is

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

[5]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 SIVs 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.

[6]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 $\gamma > 1/2$.

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 SIVs enter a subgame where they are offered transfers by producers and then choose to predate or defend. In that subgame, a SIV has the option of predating and getting at least the payoff from being the sole predator.[7] 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 SIV strictly prefers to join forces with defending SIVs 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 SIVs 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 SIV, it is always better to defend than to predate if some of the other SIVs are predating. But what about when all the other SIVs are also defending? In that case, the transfers that the producers offer will determine the choice of whether to predate or defend.

[7] 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 SIVs, who then independently decide their actions. Then, given that producers have all the bargaining power, it follows that SIVs are always pushed to their outside option.[8] This means that in every subgame after a successful defence, the producers' transfer is exactly equal to an individual SIVs 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 SIVs indifferent between being sole predators and defenders we will make the following assumption.

Assumption 2. *SIVs 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 SIV predates and everyone (including the producers) gets exactly the same expected payoff as in the case where all SIVs accept the producers' offer. [9] However such equilibria are purely an artifact of the producers pushing the SIVs 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 $s+1$ SIVs consists of producers offering each SIV a fraction*

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

of total output, with all SIVs choosing not to predate.

Proof. The proof is established by induction on the number of SIVS. Firstly, note that when there is only one SIV, his expected payoff from predation is one, since that is the probability with which he avoids mutiny and becomes an actual predator. Then, producers can ensure that he does not predate by $t = 1$: this would make the SIV indifferent between predation and non-predation, and by Assumption 1 the SIV would not predate.

Next, suppose that we have already managed to prove that the proposition holds whenever the number of SIVs is less than or equal to some

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

[9]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.

number s, and let us examine whether the proposition still holds if there are $s+1$ SIVs.

To analyse the predation and defence payoffs of an individual SIV, suppose that $p \geq 1$ of the other SIVs have decided to predate and $q \leq s-1$ have 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 SIVs. Since we are considering subgame-perfect equilibria we now 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 SIVs is at most s so that the Nash equilibrium payoff in a subgame where there are only $q+1$ SIVs 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 SIV 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 SIV all of the other SIVs 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 SIV does not predate by offering a transfer exactly equal to his predation payoff. Therefore, when there are $s+1$ SIVs, the only equilibrium is one where producers offer $t = \frac{1}{\delta s+1}$ and all SIVs do not predate. □

To reiterate, the intuition of this result is as follows. Although a larger number of predating SIVs increases the probability of a successful predation, the payoff conditional on success is weighed down by the decreased share each SIV receives.[10] As a result it is more attractive for a SIV to stave off predation with the expectation of the larger share he receives

[10]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 SIV 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 SIVs may arise.

if the defenders win. Even a marginal defensive advantage ensures that it is a dominant strategy for all SIVs to defend. If all other s SIVs are defending the payoff of a lone SIV 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 convenient to define the expropriation rate that the producers face, i.e., the fraction of total output that they transfer to the SIVS as

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

Taking the derivative of τ with respect to s we find that

$$\frac{\partial \tau}{\partial s} = -\frac{\delta - 1}{(1+\delta s)^2} < 0 \ , \tag{9}$$

since $\delta > 1$ by assumption 1. This shows that not only is the transfer paid to an individual SIV decreasing in s, but that the sum of transfers is also decreasing in the number of SIVs. This is because, as the number of SIVs increases, the deviation payoff from predation becomes worse, which in turn decreases the equilibrium transfer paid to SIVs.

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 SIVs 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 SIVs decreases their incentives to expropriate fully. The two mechanisms may be seen as complementary to one another; it is possible to imagine that the number of SIVs arises at a point where these two forces equilibrate one another.

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 SIVs are satisfied with a lower transfer and the tax rate 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 specialisation in violence 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 SIVs to have differing strengths. This allows us to examine how expropriation changes in response to changes in the distribution of strength between SIVs . 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 SIVs.

Suppose that the SIVs are indexed by i, where $i = 1, ..., s$, and let each SIV have strength x_i, which captures all factors that would contribute to increasing the probability of winning, such as the number of troops, their level of training or the quality of their equipment. Now that strengths are different, it is natural to assume that victorious predators share output proportionally to their strengths. Thus a SIV with strength x who successfully predated with other SIVs 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* $\delta > 1$, $x > 0$,

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

with strict inequality if $P > 0$.

Proof. Inequality (10) is true iff

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

$$\frac{(\delta-1)Px}{(P+\delta(Q+x)(x+\delta Q)(P+x+\delta Q)} \geq 0\,, \tag{12}$$

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 SIV has strength* x_i *is for producers to offer to each SIV a transfer*

$$t_i^* = \frac{x_i}{x_i + \delta\sum_{j\neq i} x_j}\,, \tag{13}$$

and for all SIVs 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 SIV their payoff from being the sole predator. ☐

An interesting feature of the equilibrium is that each SIV's payoff 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 amount of output that producers end up giving to the SIVs. The following proposition shows that a more equal distribution leads to lower transfers.

Proposition 3. *Suppose that SIVs* 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 paid to SIVs.*

Proof. Since the redistribution of strength keeps the sum of i and j's strengths constant, the payoff to all other SIVs 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

$$\begin{aligned}
&\frac{x_i}{x_i + \delta x_j + \delta \sum_{k\neq i,j} x_k} + \frac{x_j}{x_j + \delta x_i + \delta \sum_{k\neq i,j} x_k} \\
&\geq \frac{x_i - \varepsilon}{x_i - \varepsilon + \delta(x_j + \varepsilon) + \delta \sum_{k\neq i,j} x_k} + \frac{x_j + \varepsilon}{x_j + \varepsilon + \delta(x_i - \varepsilon) + \delta \sum_{k\neq i,j} x_k} \\
&= \frac{x_i - \varepsilon}{x_i + \delta x_j + (\delta - 1)\varepsilon + \delta \sum_{k\neq i,j} x_k} + \frac{x_j + \varepsilon}{x_j + \delta x_i - (\delta - 1)\varepsilon + \delta \sum_{k\neq i,j} x_k} .
\end{aligned} \tag{14}$$

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

$$\frac{x_i}{\sigma_i} + \frac{x_j}{\sigma_j} = \frac{x_i\sigma_j + x_j\sigma_i}{\sigma_i\sigma_j} \tag{15}$$

$$\geq \frac{x_i - \varepsilon}{\sigma_i + (\delta - 1)\varepsilon} + \frac{x_j + \varepsilon}{\sigma_j - (\delta - 1)\varepsilon} \tag{16}$$

$$= \frac{x_i\sigma_j + x_j\sigma_i - 2(\delta - 1)\varepsilon\big(x_i - x_j - \varepsilon\big)}{\sigma_i\sigma_j + (\delta - 1)^2\varepsilon\big(x_i - x_j - \varepsilon\big)} , \tag{17}$$

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 SIV to a weaker one will reduce total transfers. As a consequence, a more equal distribution of strengths yields lower total transfers to SIVs, with the minimum being achieved when all SIVs 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 SIVs 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.[11] 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*.[12] 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,

[11] 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.

[12] 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*.

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 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 attempt to test part of our model. In particular we can test remark 1 that indicates that we should expect a negative relationship between the risk of expropriation and the number of SIVs. Unfortunately we don't have the data to test remark 2 which shows that the risk of expropriation is lower when the power of SIVs is more equal.

The empirical analysis is based on panel data on World Military Expenditures and Arms Transfers dataset compiled by the US Department of state.[13] The data comprises of 168 countries over an 11 year period from 1995-2005. This contains data on our main explanatory variable, the number of active troops per one thousand. It also contains data on military and government expenditure in 2005 US Dollars which we use as

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

controls.

For our outcome variable we rely on the International Country Risk Guide (ICRG) compiled by Political Risk Services.[14] This contains an index that measures the risk of expropriation on a scale of 0-12 with a higher score indicating a lower risk. Our baseline specification is

$$y_{it} = \alpha_i + \beta_t + \gamma_1 \text{Armed Forces}_{it} + X'_{it}\lambda + \varepsilon_{it}. \tag{18}$$

The variable "Armed Forces" is the log of the number of active troops for one thousand people in the population. Note that the ideal empirical counterpart to SIVs is a variable that captures the number of military leaders who each command independent units. Since such data is unavailable we use the log of the number of armed forces instead. If the fraction of military leaders to armed forces remains constant within a country over the sample period, then there is no problem with using the armed forces variable. This is because the number of SIVs is some fraction θ_i of the number of armed forces. To see this mathematically note that

$$(1 - \tau_{it}) = c_i(\theta_i \cdot \# \text{ armed forces}_{it})^{\gamma_1} \tag{19}$$

$$\implies \ln(1 - \tau_{it}) = \ln c_i + \gamma_1 \ln \theta_i + \gamma_1 \ln(\# \text{ armed forces}_{it}) \tag{20}$$

The first two terms on the right hand side constitute the country fixed effect and cannot be identified separately. However the coefficient on the log of number of armed forces gives us an estimate of γ_1. The assumption underlying this is that the structure of military within a country, that is the proportion of soldiers and commanders stays constant.

As seen in remark 1, we should expect γ_1 to be positive. X_{it} is a vector of time varying country level controls including income as measured by log per capita GDP, log per capita government spending, log per capita military spending, log population. Since the risk of expropriation and the proportion of population in the armed forces could also be correlated to levels of internal and external conflict, we control for these using indices for these two variables that are also part of the ICRG dataset. α_i and β_t are the country and time fixed effects.

Table 1 in the appendix reports the results of this regression. We observe that the estimate of γ_1 is close to zero and statistically insignificant in all specifications. The maintained hypothesis for this regression model

[14]The investment profile component in the ICRG dataset has been widely used in the literature as a measure of risk of expropriation starting from Knack and Keefer (1995). As noted by Acemoglu et al. (2001), although the variable is designed to capture the risk of expropriation is for foreign investment, the correlation with the risk of expropriation for domestic investment is likely to be high.

is that the competition effect that we model applies equally to all countries. However it may be possible that the net effect of competition among the SIVs has a differential impact at different levels of development. In particular it is reasonable to believe that the threat of expropriation is real at lower levels of development when institutions are not well developed. On the other hand at advanced stages of institutional development, civilian control over the military is well established and consequently greater numbers within the armed forces ought not to affect the risk of expropriation. To test this hypothesis we regress the following specification where we allow the armed forces variable to interact with income

$$y_{it} = \alpha_i + \beta_t + \gamma_1 \text{Armed Forces}_{it} + \gamma_2 \text{Armed Forces}_{it} * \text{Income}_{it} + X'_{it}\lambda + \varepsilon_{it}. \tag{21}$$

Table 2 reports the results of this regression. We can see that now the estimate of γ_1 is positive and significant indicating that increasing the proportion of population in the armed forces reduces the risk of expropriation. Moreover the estimate of γ_2 indicates that as expected the competition effect is strong at low levels of development and attenuates with income.

We can also test this hypothesis by allowing the armed forces variable to have a differential impact if a country is a member of the OECD. We expect the coefficient on the interaction between OECD and armed forces to be negative since we don't expect competition among SIVs to affect the risk of expropriation within OECD countries. We run

$$y_{it} = \alpha_i + \beta_t + \gamma_1 \text{Armed Forces}_{it} + \gamma_2 \text{Armed Forces}_{it} * \text{OECD}_i + X'_{it}\lambda + \varepsilon_{it}. \tag{22}$$

Table 3 reports the results of this specification. Once again we observe that the estimate of γ_1 is positive and significant whereas the estimate of γ_2 is negative and significant. This indicates that the positive effect of competition among SIVs on investment incentives appears to be true for non OECD countries.

A potential concern with the 1995-2005 time period is that our results may be affected by the heterogeneous impact of the September 11, 2001 attacks. To address this we run our main specification from equation (21) on a sample restricted to 1995-2001. Table 4 reports the results. We observe that the results are not affected.

Another concern with these results is the endogeneity of variables such as current income, government and military expenditure, and conflict. We attempt to deal with this concern in two ways. First by taking an instrumental variables approach, and second by replacing contemporaneous regressors with their lags.

Our first attempt to address the endogeneity is through estimating the specification from equation (21) by using the lags of all variables on the right hand side. Tables 5 reports the results. We see that the pattern of results continues to be the same as seen in table 2. γ_1 continues to be positive and significant whereas γ_2 continues to be negative and significant. Table 6 reports the results from using the same set of instruments on the specification in equation (22). Once again we see the same pattern of results in relation to γ_1 and γ_2.

The instrumental variable approach is based on the identifying assumption that the lagged values of income, government expenditure, etc. do not have a direct impact on expropriation risk. Since this is unlikely to be entirely correct we also try using the lagged variables as regressors rather than as instruments. We run

$$y_{it} = \alpha_i + \beta_t + \gamma_1 \text{Armed Forces}_{it} + \gamma_2 \text{Armed Forces}_{it} * \text{Income}_{it-1} + X'_{it-1}\lambda + \varepsilon_{it} \tag{23}$$

where all the regressors except armed forces are lagged one period.[15] Table 7 reports the results of this regression. We see that although the magnitude of the effect drops, the result is consistent with the earlier specifications in that we find a positive and significant γ_1 and a negative and significant γ_2. Table 8 reports the results from regressing the lagged specification with the OECD indicator.

5 Conclusion

The ability to commit is one of the foundations of economic activity. This arises as a result of agents who specialise in enforcement of commitment through the threat of violence. How do these agents commit not to use their powers to expropriate others? This paper has attempted to answer this question. We have argued that commitment arises as an artifact of the Prisoner's Dilemma type game form within which these agents find themselves. Even though they could secure a higher payoff by colluding, they are unable to do so since unilateral adherence to their role as the protectors of the producers is always individually rational. Moreover our

[15]Since the model predicts a relationship between contemporaneous numbers in the armed forces and the risk of expropriation, we have not lagged the armed forces variable. However the results of the regression where the armed forces variable is also lagged one period are similar to the ones reported in table 7.

model shows how it is in the interest of the elite to have more diffuse power structure since that acts as credible commitment against abuse of power and as such is a first step towards a political Coase theorem.

Using within country variation to test the model, we find that competition among SIVs reduces the risk of expropriation, but only in developing countries. This is consistent with the fact that the problem of civilian control over SIVs is more salient at lower levels of institutional development. Our model therefore has implications about how to optimally structure the armed forces in less developed countries where civilian control over the military may be a problem.

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Appendix

Table 1: Not Allowing for Interaction with Level of Development

	1	2	3	4	5
Armed Forces	-0.215	0.064	0.030	0.203	0.210
	(0.25)	(0.40)	(0.41)	(0.42)	(0.39)
Income	2.921***	4.136***	4.039***	3.900***	3.860***
	(0.69)	(0.75)	(0.73)	(0.78)	(0.74)
Govt Exp		-0.796**	-0.936**	-0.932**	-1.050***
		(0.38)	(0.40)	(0.40)	(0.39)
Military Exp			0.360	0.280	0.244
			(0.27)	(0.27)	(0.26)
Population				-1.962	-2.275
				(1.74)	(1.74)
Internal Conflict					0.231**
					(0.09)
External Conflict					0.095
					(0.14)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation

Table 2: Interacting with the Level of Development

	1	2	3	4	5
Armed Forces	6.898***	6.774***	6.689***	6.977***	6.540***
	(1.19)	(1.17)	(1.17)	(1.23)	(1.18)
Income	5.197***	6.090***	6.013***	6.217***	6.062***
	(0.71)	(0.77)	(0.76)	(0.91)	(0.90)
Armed Forces *Income	-0.714***	-0.683***	-0.676***	-0.717***	-0.670***
	(0.12)	(0.12)	(0.12)	(0.14)	(0.13)
Govt Exp		-0.739**	-0.848**	-0.846**	-0.945**
		(0.37)	(0.39)	(0.38)	(0.37)
Military Exp			0.262	0.307	0.273
			(0.26)	(0.27)	(0.27)
Population				1.229	0.791
				(1.90)	(1.89)
Internal Conflict					0.196**
					(0.08)
External Conflict					0.039
					(0.13)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation

Table 3: Interacting with OECD Indicator

	1	2	3	4	5
Armed Forces	0.085	0.852**	0.820**	0.864**	0.852**
	(0.36)	(0.37)	(0.38)	(0.39)	(0.36)
Income	2.671***	4.095***	4.045***	3.994***	3.947***
	(0.68)	(0.71)	(0.70)	(0.75)	(0.71)
Armed Forces *OECD	-2.441***	-3.036***	-2.982***	-2.912***	-2.824***
	(0.63)	(0.63)	(0.63)	(0.65)	(0.64)
Govt Exp		-0.814**	-0.915**	-0.914**	-1.027***
		(0.37)	(0.39)	(0.39)	(0.37)
Military Exp			0.240	0.213	0.182
			(0.25)	(0.25)	(0.25)
Population				-0.720	-1.058
				(1.78)	(1.77)
Internal Conflict					0.216**
					(0.09)
External Conflict					0.099
					(0.13)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation

Table 4: Results on the sample restricted to 1995-2001

	1	2	3	4	5
Armed Forces	6.122***	4.840**	4.344*	5.948**	5.451**
	(2.26)	(2.35)	(2.37)	(2.65)	(2.50)
Income	6.069***	6.955***	6.574***	7.679***	7.255***
	(1.07)	(1.09)	(1.07)	(1.30)	(1.27)
Armed Forces *Income	-0.578**	-0.467*	-0.434*	-0.633**	-0.572**
	(0.23)	(0.24)	(0.24)	(0.29)	(0.27)
Govt Exp		-0.980**	-1.215***	-1.275***	-1.436***
		(0.44)	(0.44)	(0.44)	(0.47)
Military Exp			0.502*	0.582**	0.498*
			(0.28)	(0.29)	(0.28)
Population				5.161*	4.840*
				(2.90)	(2.79)
Internal Conflict					0.271**
					(0.11)
External Conflict					0.088
					(0.17)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation

Table 5: Instrumental Variables

	1	2	3	4	5
Armed Forces	6.120***	6.777***	6.618***	6.764***	6.397***
	(1.48)	(1.33)	(1.34)	(1.41)	(1.44)
Income	4.765***	6.068***	6.055***	5.974***	5.842***
	(0.63)	(0.69)	(0.71)	(0.73)	(0.75)
Armed Forces *Income	-0.654***	-0.687***	-0.672***	-0.702***	-0.672***
	(0.14)	(0.13)	(0.13)	(0.14)	(0.14)
Govt Exp		-0.735***	-0.885***	-0.824***	-0.887***
		(0.27)	(0.28)	(0.28)	(0.28)
Military Exp			0.245	0.309	0.267
			(0.20)	(0.21)	(0.21)
Population				1.207	0.830
				(1.21)	(1.23)
Internal Conflict					0.174***
					(0.06)
External Conflict					0.024
					(0.08)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation
Right hand side variables instrumented by lags of Armed Forces, Income, Armed Forces*Income, Govt Exp, Military Exp, External Conflict, Internal Conflict, and Population.

Table 6: Instrumental Variables with OECD Indicator

	1	2	3	4	5
Armed Forces	0.371	1.250***	1.246***	1.239***	1.124**
	(0.39)	(0.42)	(0.43)	(0.44)	(0.44)
Income	2.090***	3.811***	3.906***	3.798***	3.691***
	(0.50)	(0.58)	(0.59)	(0.58)	(0.59)
Armed Forces *OECD	-4.694***	-4.957***	-4.891***	-5.053***	-4.933***
	(0.98)	(0.92)	(0.94)	(1.00)	(1.00)
Govt Exp		-0.694**	-0.810***	-0.775***	-0.842***
		(0.28)	(0.28)	(0.28)	(0.28)
Military Exp			0.127	0.150	0.119
			(0.21)	(0.21)	(0.21)
Population				0.474	0.119
				(1.17)	(1.17)
Internal Conflict					0.174***
					(0.06)
External Conflict					0.081
					(0.08)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation
Right hand side variables instrumented by lags of Armed Forces, Income, Armed Forces*Income, Govt Exp, Military Exp, External Conflict, Internal Conflict, and Population.

Table 7: Using Lagged Variables

	1	2	3	4	5
Armed Forces	4.482***	4.899***	4.836***	4.827***	4.782***
	(1.18)	(1.18)	(1.21)	(1.22)	(1.23)
Lag Income	4.393***	6.152***	6.064***	5.826***	5.916***
	(0.94)	(1.03)	(1.07)	(1.15)	(1.15)
Armed Forces	-0.629***	-0.610***	-0.605***	-0.588***	-0.578***
*Lag Income	(0.16)	(0.15)	(0.16)	(0.16)	(0.16)
Lag Govt Exp		-1.209***	-1.247***	-1.226***	-1.283***
		(0.44)	(0.44)	(0.45)	(0.45)
Lag Military Exp			0.144	0.095	0.070
			(0.38)	(0.38)	(0.39)
Lag Population				-1.626	-1.782
				(1.95)	(1.97)
Lag Internal Conflict					0.026
					(0.08)
Lag External Conflict					-0.006
					(0.13)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation

Table 8: Using Lagged Variables with the OECD Indicator

	1	2	3	4	5
Armed Forces	0.148	1.158***	1.129**	1.172**	1.215***
	(0.33)	(0.43)	(0.45)	(0.46)	(0.46)
Lag Income	1.987***	4.051***	3.986***	3.881***	3.978***
	(0.75)	(0.82)	(0.84)	(0.90)	(0.88)
Armed Force *OECD	-2.258***	-3.040***	-3.001***	-2.903***	-2.906***
	(0.61)	(0.66)	(0.67)	(0.68)	(0.69)
Lag Govt Exp		-1.232***	-1.271***	-1.258***	-1.332***
		(0.44)	(0.45)	(0.46)	(0.45)
Lag Military Exp			0.136	0.109	0.089
			(0.35)	(0.36)	(0.36)
Lag Population				-0.951	-1.081
				(2.01)	(2.03)
Lag Internal Conflict					0.031
					(0.08)
Lag External Conflict					0.029
					(0.13)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors reported in parentheses.
All specifications with Country and Year fixed effects.
Dependent Variable: Risk of Expropriation