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ABSTRACT

The Market for Protection and the Origin of the State*

We examine a stark setting in which security or protection can be provided by self-governing groups of for-profit entrepreneurs: kings, lords, or mafia dons. Though self-governance is best for the population, it faces problems of long-term viability. Typically, in providing security the stable market structure involves competing lords, a condition that leads to a tragedy of coercion: all the savings from the provision of collective protection are dissipated and welfare can be as low or lower than in the absence of a state.

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NON-TECHNICAL SUMMARY

Economists agree about the importance of well-defined property rights, about the protection of property rights being a quintessential collective good and the close connection between protection of property rights and economic performance. The need for provision of property rights has often been seen as a central motivation for the formation of the state in which the power to provide secure property rights is delegated to some kind of government. However, protection is not an ordinary good. Agents who control the means for the provision of protection of property rights can easily use these means to extort the same persons they are supposed to protect. In Public Economics the government's power to extort has been widely recognized by many authors writing about the Leviathan state, the power to tax and so on, but little theoretical work has been done to explain which governmental structures are viable in a fully non-cooperative situation in which agents cannot commit not to abuse their enforcement powers.

This Paper explores the close connection between the power to provide protection and the power to extort on those who are to be protected. We ask which structures of governance are viable and can be obtained as the equilibrium outcome in a non-cooperative situation in which all agents cannot commit on not using their power for extortion and we determine the welfare properties of different structures of governance.

We begin by considering a simple and fragmented economy in which agents are endowed with some factors of production and must spend part of their resources for providing their own protection. In this society in which state is absent, some individuals ('peasants') will use their endowments for producing and for protecting their resources and output, whereas other agents will turn into bandits, trying to take away from others. The equilibrium outcome is inefficient, because bandits do not contribute to aggregate output, and peasants waste part of their time to protect themselves against bandits.

Assuming that protection has some public good characteristics, we next consider a structure in which peasants form small self-governed groups in which protection for the whole group is provided by voluntary contributions to collective protection. Compared to a society without state, welfare is higher under self-governance, but the free-riding incentives in such self-governed communities yield underprovision of protection.

We then consider the possibility that a for-profit protection agency (a Leviathan) enters and monopolizes protection, but also uses the machinery of protection to keep his subjects in conditions no better-off than in the absence of a state. Because of the efficiency of collective protection that Leviathan

employs, however, output can be much higher than in the absence of the state, with all the surplus appropriated by Leviathan. The rents that are thus created will attract competitors, competing ‘lords’, who attempt to set up their own protection business. In the long-run, the number of protection agencies is such that no further entry is profitable, implying that all agents abstaining from entry obtain the same net income as agents who entered and run a protection agency. We call this outcome the competing lords regime.

We compare the different outcomes and conclude that the long-run equilibrium, with competing lords without further entry, is the most likely equilibrium. The welfare properties of this equilibrium are not very appealing, and the outcome to everyone is higher or lower than in the absence of state, depending on the lords’ power to extract revenue. If their power is similar to that of bandits in the absence of state then all agents earn the same net income as in the absence of state. Although the lords’ protection technology is superior to that in the absence of state, this does not translate in higher economic welfare. All the savings from the provision of collective protection are dissipated in lords’ contests, and welfare can be as low or lower than in the absence of a state.

Although the environment we examine is very stark and is not meant to apply to the form of political organization of modern industrialized states themselves, our approach helps illuminate the nature of power in many developing and transitioning economies and in those areas within modern states with power vacuums that allow gangs and mafias to develop. We tell a story with peasants and bandits which also applies to interactions among shopkeepers and robbers in Moscow, inner-city Los Angeles, or Lagos. In such cases, gangs come in to fill the gap vacated by the modern state, supplanting it and creating a near monopoly of force in their area. We help understand why genuine community policing is difficult and hierarchical gangs and mafias emerge instead.

Introduction

Our understanding of economic performance in many transition economies, developing countries, and even industrialized economies is often clouded by unidimensional assumptions about the functioning of states and governments - from the mainstream view of governments as maximizing social welfare to that of some quarters of the public choice school that view all states as predators. A casual look at today's world, though, reveals a variety of types of state: stable liberal democracies; authoritarian regimes; outright kleptocracies; politically fragmented (almost anarchic) formations. Within states, there are also differing extents of control. In history there has been even more variety (e.g., Ronald Findlay, 1990 or Charles Tilly, 1992). The implications for the economy of the different types of state are obviously very different and the "one size fits all" view of government is inadequate and in many cases, especially for developing and transition economies, misleading.

A possibly helpful analogy is to think of the state as an onion, albeit with layers that have different character and color. Layers of autocratic and coercive habits lie below others with more democratic conventions, constitutions, and legal procedures. Once in a while, something occurs and pierces the modern layers leading to the previous ones that lay dormant. Outbreaks of violence, coercion, and horrors can ensue. Our purpose in this paper is to improve understanding of what lies in these deeper layers, in the subcortex of the State's brain. We are sure that whatever insights come out of this exercise will not be novel; some economist or political philosopher from the recent or distant past would have said it before.[1] Our primary contribution is in using the modelling language of modern economics to sift through some of the insights and to communicate them compactly; the different perspective could possibly also add something new.

We focus on the provision of the quintessential collective good provided by the state, variously referred to as *security, order, protection of property rights*, or simply, *protection*. Arguably, this has been historically the first type of good provided by states. Security is also logically a precondition for the provision of ordinary infrastructural public goods and generally for facilitating trade and economic development. What sets it apart, though, and its variations from other collective goods is the following characteristic: The inputs that are used for its production - soldiers and policemen, swords and guns - contain the seeds for the good's own destruction. And at times these seeds can sprout very fast. Policemen and soldiers, by virtue of their positions, could extract even more than the robbers and bandits they are supposed to guard against. Similarly, rulers who provide protection against internal and external threats can use their power of extraction at an even grander scale. Army generals and colonels, ostensibly at the service of democratic governments, can, and regularly do, topple such governments. Clearly protection is not an ordinary good.

To clarify the nature of protection and its relation to the emergence of the state, we begin with a hypothetical condition, anarchy, in which the population sorts itself between individual peasants and bandits and no organizations provide collective security. The two types of state that can emerge are those that are consensually or democratically organized and those that are imposed by force and they can be referred to as predatory. We further classify predatory states into monopoly states that face no competition, "Leviathans", and multiple competing ones. We show how - depending on population size, the fixed costs of establishing an organized state, and the technology of conflict - the most likely stable outcome that emerges endogenously is to have multiple predatory states. Each predatory state hires guards to protect its sequestered peasants from bandits, hires warriors to protect its borders from the other states, and receives income from tribute extracted from its peasant subjects. The consensually organized, self-governing state could survive in the absence of predators, and although collective security would be underprovided and it would be small in size, the welfare of peasants and bandits would be highest under this regime. In the presence of competing predators, however, the likelihood of a self-governing state surviving is minimal. Moreover, under the regime with competing predatory states, total output is essentially identical to the condition without a state; all the savings accruing from the provision of internal protection are dissipated in fighting over the same rents created by those savings. It is even possible for total output to be lower than that under anarchy. Thus as far as the market for protection is concerned, competition among predatory entrepreneurs is not a good thing.

Compared to other work that has viewed the state as maximizing its revenue while providing a public good (Geoffrey Brennan and James Buchanan, 1977, 1978; Merwan Engineer, 1989; Findlay, 1990; Mancur Olson, 1991; Herschel Grossman and Suk-Jae Noh, 1994; Douglas Marcouiller and Leslie Young, 1995; Martin McGuire and Olson, 1996), we take account of the aforementioned peculiar status of protection relative to other public goods. We also allow for the distribution of output, including taxation by the state, to depend explicitly on the relative ability of affected parties to use force. Thus taxation has a direct resource cost, whereas the cost of taxation in the existing literature is indirect, as deadweight loss or reduction in market activities. More importantly, in contrast to all this work, we do not suppose a single Leviathan state, but we allow for the possibility of many competing ones that can arise endogenously to provide security, including the limiting case of a single such state. Dan Usher (1989) is probably closest to this paper; but while we are interested primarily in contrasting the different types of states that can arise, Usher's main interest is in the alternation between despotism and anarchy.[2]

We have tried to clarify the nature of the state in its earliest form by examining a stark environment in which security is the main collective good. We would like to emphasize though, that we do not claim that modern states as they have developed in the past two centuries have a strong resemblance to the type of states we examine here. However, our approach can help understand the nature of power in many developing and transition economies, especially in places in which there was little recent political involvement of the local population and local elites prior to the formation of the state.

Finally, our model sheds some light for areas within modern states with power vacuums that allow gangs and mafias to develop. As Diego Gambetta (1993) argues the primary commodity sold by the Sicilian mafia is protection (for modeling dedicated to the activities of mafias and gangs see Grossman, 1995, Michelle Polo, 1995, Skaperdas and Constantinos Syropoulos, 1995, and other contributions in Gianluca Fiorentini and Sam Peltzman, 1995, Kai Konrad and Skaperdas, 1997, 1998). We tell a story with peasants and bandits which also applies to interactions among shopkeepers and robbers in Moscow, Los Angeles, or Lagos. In the latter case gangs come in to fill the gap vacated by the modern state, supplanting it and creating a near-monopoly of force in their area. We help understand why genuine community policing is difficult and why gangs arise in conditions with a power vacuum.

I. Peasants and bandits in anarchy

We begin with a setting in which there is complete absence of collective organizations. Individuals out of a population N sort themselves among peasant farmers and bandits where the latter make a living by preying on the peasants. (A similar story could be told for an anarchic urban setting by having workers and robbers - instead of peasants and bandits - as the two possible occupations.) Each peasant has one unit of a resource that he can distribute between work and self-protection and, therefore, the higher is the level of self-protection, the lower is the amount of work and the lower is the output that can be produced. Denoting this self-protection activity by x, the peasant can keep a share $p(x)$ of output away from bandits, where $p(x)$ is increasing in x, $p(x)\in[0,1]$ for $x\in[0,1]$, $p(0) = 0$ and $p(1) = 1$. Thus the payoff of a peasant is as follows:

$$(1) \qquad U_p = p(x)(1-x)$$

Each peasant chooses a level of self-protection x so as to maximize his payoff in (1). We suppose a unique such level, denoted by x^*. For the remainder we also denote the payoff associated with x^* by U_p^*.

The bandits roam the countryside looking for peasants to prey upon. Let N_p denote the number of peasants and let N_b be the number of bandits.[3] The bandit's payoff is as follows:

$$(2) \qquad U_b = (1-p(x))(1-x)N_p/N_b$$

That is, bandits extract $1-p(x)$ of output from each peasant and the more peasants there are relative to bandits, the better it is for a bandit.[4]

Given that a peasant's payoff is uniquely determined by the choice of x^* (and equals U_p^*), we are interested in an equilibrium state whereby the numbers of bandits and peasants adjust until a bandit's payoff equals that of a peasant. Formally, an *anarchic equilibrium* is a number of peasants N_p^*, a number of bandits N_b^*, and a bandit's payoff U_b^* such that $N_p^* + N_b^* = N$ and $U_b^* = U_p^*$.[5] We suppose a unique such equilibrium, with the numbers of peasants and bandits given by:

$$(3) \qquad N_p^* = p(x^*)N \quad \text{and} \quad N_b^* = (1-p(x^*))N$$

The easier is to defend agricultural output from bandits, as captured by the properties of the function $p(\cdot)$ and the amount of self-protection induced, the more peasants there are relative to bandits. Total output, which we will use in welfare comparisons with institutional arrangements we will examine later on, equals:

$$(4) \qquad N_p^*(1-x^*) = p(x^*)(1-x^*)N$$

Compared to the "Nirvana" condition without banditry, in which total output would equal N, the lower output under anarchy has two sources: (i) The fact that bandits do not contribute anything to production [the associated welfare loss equals $(1-p(x^*))N$] and (ii) those who become peasants have to divert some of their resources toward self-protection [the associated welfare loss is $p(x^*)x^*N$]. With $p(x)=x$, $x^* = 1/2$, there are as many bandits as peasants and total output is 1/4 of potential output.

II. Collective protection: preliminaries

In addition to each peasant taking self-protection measures against bandits privately, several peasants, a village, or a district could take protection measures collectively. Such measures can include simple warning systems about the presence of bandits in the area, the formation of a (part-time) peasants' militia that becomes activated when there is bandit threat, the building of rudimentary fortifications to protect crops or other property, or the hiring of full-time guards and policemen. Here we abstract from the particular forms that collective protection can take and we simply suppose that collective protection is homogenous and a substitute for individual self-protection, albeit collective protection can be provided more efficiently than self-protection. Letting z ($\in[0,1]$) denote the group's average (per peasant) expenditure on collective protection consisting of k peasants, the amount of collective protection received by each peasant is a function $f(z)$ with the following properties:

(5) $f(0) = 0$; $f(z) > z$ for all $z\in(0,1)$; $f(1) = 1$; $k \geq \bar{k}$ for some $\bar{k} > 1$; also suppose $f(\cdot)$ is concave, twice differentiable except possibly at one point, and its inverse exists.

The share of own output retained by a peasant who has contributed x_i to self-protection and z_i to collective protection is $p(x_i+f(z))$, where $z = \sum_{j=1}^{k} z_j/k$ and z_j is the contribution of peasant j in the collective protection of the group. The absence of expenditures on collective protection yields zero actual collective protection for each peasant in the group. The key property in (5) is $f(z) > z$ which implies that if each peasant in the group were to contribute an amount z to collective protection, instead of contributing it to self-protection (denoted by x earlier), he or she would receive a higher level of effective protection overall. To have this type of protection truly collective, we require that the number of peasants in a group should have a minimum size $\bar{k}$ that equals at least two. The remaining properties in (5) are convenient for technical reasons. Two examples of $f(\cdot)$ are:

(6a) $$f_a(z) = z^{\beta} \text{ where } \beta \in (0,1) \quad \text{and}$$

(6b) $$f_b(z) = \begin{cases} Bz & \text{if } z \leq 1/B \quad B>0 \\ 1 & \text{otherwise} \end{cases}$$

Taking account of collective protection, the payoff of peasant i becomes:

(1') $$U_{pi} = p(x_i+f(z))(1-x_i-z_i) \qquad [z = \sum_{j=1}^{k} z_j/k]$$

To gain intuition about the effects of the collective protection technology but also to facilitate comparisons with the non-cooperative choices we examine later, we briefly consider optimal choices of protection that maximize a welfare objective that takes the size (k) and composition of a group of peasants as given. The objective is to choose x_is and z_is (i=1,...,k) so as to maximize the sum of the payoffs of the peasants belonging to the group:

(7) $$V = \sum_{i=1}^{k} U_{pi} = \sum_{i=1}^{k} p(x_i+f(z))(1-x_i-z_i) \qquad [z = \sum_{j=1}^{k} z_j/k].$$

Given that x_i and z_i have the same cost to a peasant but the average protection is higher with collective protection ($f(z) > z$), we could be tempted to say that optimal protection should involve only collective protection. This is not always true, however, since especially given the concavity of $f(\cdot)$ the marginal return of collective protection could fall below the return of private protection (which, given our specification, equals unity). Thus, the optimal choice of protection involves choosing collective protection up to a certain point where $f'(z) \leq 1$. When $f'(z)>1$, no private self-protection is undertaken, whereas with $f'(z)=1$ some self-protection could be undertaken. Whether or not some self-protection is optimal will depend on the functional form.

Choosing the right levels of collective and private protection would require a benevolent agent who would also have the power to impose such choices. This would amount to assuming away the problem we set out to examine. Thus, instead our task in the remainder is to explore different alternatives that could emerge from anarchy and that utilize the more efficient collective protection technology.

III. Self-governance

One way to take advantage of the higher efficiency of collective protection is for peasants to form a community and voluntarily contribute to collective protection, say through a part-time peasants' militia. It has been argued that for most of human pre-history small self-governing bands, rarely larger than two hundred persons, had been the primary form of political organization (Jared Diamond, 1997, Ch.14). In historical times examples of democratic or quasi-democratic forms of political organization can be found in the city states of the Ancient Mediterranean world or of early modern Europe.[6] Before the appearance of the modern constitutional states, these self-governing political organizations appear to have had two characteristics: small relative size and problems of long-term viability. We shall now primarily explore the reasons for small size as they are related to the provision of collective security; although we touch upon the issue of long-term viability as well, we postpone a more comprehensive discussion until later.

Consider a group of k $(\geq \bar{k})$ peasants, with the number k initially given, who voluntarily choose between useful production, contributions to collective protection, and self-protection. That is, each peasant i that belongs to the group chooses x_i and

z_i (and therefore also chooses useful production which equals $1-x_i-z_i$) so as to maximize his payoff as given by (1'):

$$(1') \qquad U_{pi} = p(x_i+f(z))(1-x_i-z_i) \qquad [z = \sum_{j=1}^{k} z_j/k]$$

These choices are simultaneously made by all peasants in the group and we are thus interested in exploring the properties of (Nash) equilibria of this game. To do that, we first consider peasant i's incentives to choose x_i and z_i as indicated in the following partial derivatives:

$$(8a) \qquad \partial U_{pi}/\partial x_i = p'(x_i+f(z))(1-x_i-z_i) - p(x_i+f(z))$$

$$(8b) \qquad \partial U_{pi}/\partial z_i = p'(x_i+f(z))(1-x_i-z_i)f'(z)/k - p(x_i+f(z))$$

The first term of each equation represents the (private) marginal benefit of each protection activity, whereas the second term represent its marginal cost. Note how the private marginal benefit of contributing to collective protection in (8b) is just $1/k$ of its marginal social benefit. By comparing (8a) to (8b), a peasant's benefits of an increase in x_i exceed his or her benefits of an increase in z_i if and only if $f'(z) > k$. A more efficient collective protection and a smaller group size increase the incentives for individual contributions to collective protection.[7] In this setting three different types of equilibria can occur:

(a) $z_i = z = 0$, $x_i = x^* > 0$ (quasi-anarchy with only private protection.)

(b) $z_i = z \equiv \hat{z} > 0$, $x_i = 0$ (only collective protection.)

(c) $z_i = z \equiv \hat{z} > 0$, $x_i \equiv \hat{x} > 0$ (both types of protection used).

Using standard techiques, the following properties can be shown to hold (for proofs please see the 1997 working paper version of the paper):

Property *(i)*: Equilibrium collective protection is non-increasing in group size k and strictly decreasing for type (c), and for type (b) if $p(f(\hat{z})) < 1$.

Property *(ii)*: Equilibrium private protection is constant with respect to group size

k for types (a) and (b) and strictly increasing for type (c).

Property *(iii)*: The level of protection (i.e., the share retained by each peasant) is at least as high as under anarchy. It is always strictly higher for type (c), and it is strictly higher for (b) if $p(f(\hat{z})) < 1$.

Property *(iv)*: Individual welfare is non-increasing in group size. It is always constant for type (a), it is always strictly decreasing for type (c), and it is strictly decreasing for type (b) if $p(f(\hat{z})) < 1$.

Property *(iv)* of the mixed type *(c)* of equilibrium implies that, if we were to allow for an endogenous determination of group size, the size that would most likely emerge is the minimal one for which collective protection is possible (i.e., $\bar{k}$). For instance, in addition to having individuals making choices between becoming peasants and bandits, those who choose to become peasants could also choose to become part of a group.

To be concrete, let a *self-governing equilibrium* be a number of peasants $\hat{N}_p$, a number of peasant groups $\hat{n}_p$, and a number of bandits $\hat{N}_b$ such that:

(I) Each peasant belongs to a group, chooses private and collective protection strategically as described in Proposition 1, and has no incentive to join another group or become a bandit;

(II) Each bandit does not have an incentive to join a peasant group;

(III) $\hat{N}_p + \hat{N}_b = N$.

Concentrating on the mixed type of within-group equilibrium type *(c)* (but also equilibrium of type *(b)* if $p(f(\hat{z})) < 1$), part (I) implies that in a self-governing equilibrium peasants have equal payoffs across groups and, therefore, all groups must have the same size. Moreover, group size must equal $\bar{k}$, since otherwise there would be an incentive for some peasants to form a smaller group and, by Property *(iv)* , have higher payoffs. Part (II) implies that the payoff of the bandits must equal that of peasants, provided security is less than complete and there is a positive number of bandits in such an equilibrium. The following Proposition summarizes the basic findings on self-governing equilibrium.

Proposition 1: *Suppose a collective protection technology that induces a type (b) equilibrium with* $p(\cdot)<1$ *or a type (c) equilibrium. Then, a self-governing equilibrium will have the following properties: (i) Each group is of minimum size,* $\bar{k}$*; (ii) the number of peasants* ($\hat{N}_p$) *is higher than the number of peasants under anarchy* (N_p^*) *and the number of bandits* ($\hat{N}_b$) *is lower than the number of bandits under anarchy* (N_b^*)*; (iii) the welfare of peasants and bandits alike is higher than that under anarchy.* (The proof can be in the 1997 working paper as proof of Proposition 2.)

Since the minimal scale for collective protection against bandits, $\bar{k}$, can be considered small the self-governing groups that will form will be of small size. We should note that self-governance involves in practice considerable coordination and decision costs, something that would also favor small size and, in combination with the free-rider problem, could render self-governance even more problematic than it appears in our analysis thus far.

Perhaps we need go no longer than this to understand the second important characteristic of self-governing political formations, their relative scarcity or disappearance in early human history.[8] This characteristic though must also be related to their take-over by autocratic or totalitarian formations, to which we now turn.

IV. Protection for Profit

Instead of having peasants voluntarily provide a portion of their time for collective protection, an entrepreneur - Leviathan, the chief, local lord or Mafia don - could hire full-time guards to protect peasants against bandits in return for tribute. His objective would be to maximize the difference between his receipts from tribute minus his costs. Receipts from tribute are likely to be higher the better is the level of protection and the larger is the number of peasants. Thus, it appears that as far as collective protection is concerned an entrepreneur could have strong incentives to provide it. The catch is of course what the peasants can get out of this; the machinery of protection against bandits can double as that of extortion against peasants.

IV.A Monopoly protection by Leviathan

We begin with the simpler form of market structure in this context, whereby protection is provided monopolistically by Leviathan. Monopoly is also virtually the only form of market structure that has been studied in other work, starting with Brennan and Buchanan (1977), on the profit-maximizing state and therefore we can make appropriate comparisons more easily.

Leviathan can utilize the same collective protection technology introduced in section II. He hires guards to protect peasants against bandits but also to extract tribute from the same peasants. Letting N_g denote the number of guards and, as earlier, letting N_p be the number of peasants, $f(\alpha N_g/N_p)$ are the units of collective protection received by each peasant, where $\alpha \in (0,1]$. That is, α represents the proportion of guards that can be used for genuine protection, with the rest of the guards being used towards the extraction of tribute from peasants. The extraction of tribute is also facilitated by an elite corps, the praetorians, who also monitor the guards in their duties, defend Leviathan against them, contribute to administration, and they generally serve as a *portmanteu* variable for factors we cannot completely specify here.[9] The number of praetorians, N_{pr}, is fixed and the cost of hiring them is considered the fixed cost of entry when entry in the protection business becomes possible in the next subsection. Both guards and praetorians receive the same payoff as the peasants and bandits.

The payoff of these occupations is determined by how much the peasants manage to keep. For given numbers of guards and peasants, and self-protection level x by a peasant, the maximum share of output that could theoretically be retained by the peasant is $p(x+f(\alpha N_g/N_p))$. However, as Leviathan has all the coercive machinery of guards and praetorians at his disposal, peasants can retain only whatever they can keep from being snatched away from them. As we hypothesized the existence of the function $p(x)$, that shows how much can peasants keep away from bandits, so we suppose a *resistance* function $\rho(x)$ that indicates the share of output a peasant can keep away from Leviathan and his agents for any given level of self-protection x. ($\rho(x)\in[0,1]$ with $\rho(0)=0$ and $\rho(1)=1$.) Bandits take $1-p(x+f(\alpha N_g/N_p))(1-x)$ from each peasant, Leviathan's tribute equals $[p(x+f(\alpha N_g/N_p))-\rho(x)](1-x)$, and each peasant retains $\rho(x)(1-x)$ of output. Each peasant chooses x to maximize $\rho(x)(1-x)$ and we suppose a unique such choice $\hat{x}$, and the payoff of peasants - as well as that of bandits, guards, and praetorians - is $\rho(\hat{x})(1-\hat{x})$.

When $\rho(x) < p(x)$ for all x, we can say that peasants resist Leviathan less than they resist against bandits (or, Leviathan can extract from peasants more easily than bandits can). As Leviathan is more organized than individual bandits we should perhaps expect this to be the more likely condition. When $\rho(x)$ is a strictly convex transformation of $p(x)$, then $\rho(x) < p(x)$ and it can be shown that $\hat{x} > x^*$ and $\rho(\hat{x})(1-\hat{x}) < p(x^*)(1-x^*)$. That is, in such a case in which Leviathan can extract more easily from peasants than bandits can, peasant self-protection is higher, individual output is lower, and peasant (as well as guard and praetorian) payoff is also lower than under anarchy. . Although we will examine this case to understand some of its effects, for analytical convenience we will then revert to the simpler case in which $\rho(x) = p(x)$.

Since the numbers of peasants and bandits depend on the level of protection which in part depends on the number of guards, Leviathan needs to take account of the effect his choice of N_g has on the number of peasants, N_p. If $p(\hat{x}+f(\alpha N_g/N_p)) < 1$ and security is less than perfect, there will be a positive number of bandits N_b (= $N-N_g-N_p-N_{pr}$), with the payoff of a bandit equalized to that of a peasant, from which we can derive implicitly the number of peasants that would emerge. When security is perfect and there are no bandits, the number of peasants simply equals $N-N_g-N_{pr}$. Overall, for each choice of N_g there will be an induced number of peasants, and we denote that by the function $\nu(N_g)$. Leviathan's objective is to maximize his net receipts by the choice of N_g, provided these receipts are positive, while taking into account the effect on the number of peasants as described by $\nu(N_g)$:

(9) $$V_L = \nu(N_g)[p(\hat{x}+f(N_g/\nu(N_g)))-\rho(\hat{x})](1-\hat{x}) - (N_g+N_{pr})\rho(\hat{x})(1-\hat{x})$$

The first term in (9) represents Leviathan's gross revenues (number of peasants times tribute rate times output per peasant). The second term represents the cost of hiring guards and praetorians.

We first show by example what can occur when Leviathan can extract tribute from peasants more easily than bandits can. Suppose $p(x)=x$, $\rho(x)=x^2$, and $f(z)=z^{1/2}$. Then, under anarchy $x^*=1/2$, the payoff of peasants is 1/4, half of the population are bandits and half peasants, and total output is $N/4$. Under Leviathan, $\hat{x}=2/3$, the payoff of peasants and those of the other occupations is just 4/27, but security is perfect and the number of peasants is $0.9(N-N_{pr})$, higher than that under anarchy for most values of N_{pr} that yield a positive payoff for Leviathan. However, because peasants who are under Leviathan's heavy boot do not produce as much, total output is $(3/10)(N-N_{pr})$ which for $N_{pr}>(1/6)N$ (but not too high, so Leviathan's payoff is positive) is lower than total output under anarchy. Thus, contrary to some of the arguments in McGuire and Olson (1996), Leviathan not only may not improve output compared to anarchy but also may actually leave a scorched earth of lower total output, as well as lower welfare for everyone except Leviathan (or, possibly some of his entourage which could be easily incorporated into the model). The key to this finding is a high extractive capacity of Leviathan combined with an inability to commit against using this capacity.

Having made this point, for convenience we will focus on the remainder on the simpler case in which Leviathan and bandits have exactly the same extractive capacity ($\rho(x)$=p(x) for all x). The following Proposition summarizes our findings with (part *(i)*) and without (part *(ii)*) the higher extractive capacity by Leviathan.[10]

Proposition 2: *(i) If Leviathan can extract from peasants more easily than bandits can* (i.e., $\rho(x)$<p(x) for all x), *then total output under Leviathan's rule can be lower than total output under anarchy.*

(ii) Suppose Leviathan and bandits can extract equally well from peasants (i.e., $\rho(x)$=p(x) for all x) *and assume* α=1. *Further, suppose* p(•) *is concave* and f(•) *satisfies* (5). *If the fixed number of praetorians,* N_{pr}, *is sufficiently low, there is a choice of guards that maximizes Leviathan's payoff at a positive level. Such a choice has the following properties: (a) Total output under Leviathan is higher than total output under anarchy; (b) Total output under Leviathan may be higher or lower than total output under self-governance; the lower* N_{pr} *is and the higher* $\bar{k}$ *is, the higher the ratio of the two outputs is and, therefore, the more likely that output is higher under Leviathan.* (For the proof of part *(ii)*, please see the proof of Proposition 3 in the 1997 working paper version.)

When Leviathan is not better than bandits in extracting tribute from peasants, total output is higher than under anarchy *(iia)* but does not have to be higher than that under self-governance, despite the latter's free-rider problem. The cost of taxation as manifested in the high self-protection levels of the peasants, along with a high fixed cost and small minimum size for the collective protection technology, can make output under self-governance higher.

With Leviathan appropriating all the extra output and having all the coercive machinery at his disposal, it would be rather difficult for self-governing states to survive in his presence. Thus the first state to develop a standing army in Europe, Macedonia under Philip II and Alexander, was able quickly to dominate Athens and the other city-states of southern Greece. However, the story does not end there. Leviathan does not remain unchallenged. The riches he acquires are bound to be contested, by his own guards and praetorians and even by simple peasants. Alexander's empire was divided up and fiercely fought over after his death, and several centuries passed before the Roman Empire started to consolidate rule. We turn next to what was happening in the meantime.

IV.B. Competing Lords

Instead of having a single Leviathan and small-time challengers contesting his rule, we will now examine the case in which all individuals *ex ante* are potential little Leviathans or lords; they can chose this occupation just as they would choose to be peasant, bandit, praetorian, or guard. A lord's job is similar to that of Leviathan in the hiring of praetorians and guards and in receiving tribute from peasants. We continue to maintain the same assumptions about the technology of collective protection and about the sharing of the surplus between lord and peasant. For simplicity, we continue to suppose that $\rho(x)$=p(x) so that a peasant contributes x^* to his private protection and his payoff equals p(x^*)(1-x^*) and we will also set α=1.

The lord, though, has a major headache that Leviathan did not have. Other lords are now after tribute received from peasants, and he needs to defend that tribute against them. He can do that by hiring warriors to keep the other lords outside his territory (and keep the sequestered peasants in) and possibly gain additional territory at their expense. But then the other lords will respond in kind. Thus the new element in the lords competing against one another is that they will have to hire warriors as well.

In this setting peasants have limited options. They could conceivably decide to go it alone, but they would then receive the same payoff as under a lord. They might also try to join a self-governing state, but in Appendix B we can only find conditions that lead to an even lower payoff than under a lord or under anarchy. Therefore, here we suppose that peasants are tied to their land and at the mercy of the lords who compete over how to divide them up. This is a rather different type of competition than the one typically assumed by economists, whereby different jurisdictions attempt to attract mobile subjects though lower taxation or other privileges. Whereas this type of competition takes place in much of the world today and some economic historians (e.g., North and Thomas, 1973) have argued for its importance in the rise of the West, this is hardly the most widespread form of competition that has existed in the past or the only form of competition that is taking place today. From Mesopotamia to China, Egypt, Mesoamerica, or feudal Europe, serfs were tied to the land and free peasants typically had no outside options, with rulers coming and going but without any change in their incentives for production. Even in the past two centuries, with the rise of the rights of man, the most liberal of states have sequestered their citizens with barbed-wire borders and passport controls. While we do not deny the importance of tax-and-privilege competition of mobile subjects, we find the complete lack of study of this other significant form of competition based on the use of force as providing ample reasons for a first look.

Let n_{wl} denote the number of warriors hired by lord l. For a given number of lords N_l and peasants N_p, the number of peasants that lord l can sequester, and receive tribute from, is given by

$$(10) \qquad q(n_{wl}, n_{w-l})N_p$$

where $n_{w-l}=(n_{w1},..,n_{wl-1},n_{wl+2},..,n_{wN_l})$ is the vector of warriors hired by the other lords. Also, $q(\cdot)$ satisfies the following properties:

(11) $q(\cdot)\in[0,1]$ is a symmetric, twice differentiable function which is increasing in its first argument and decreasing in the remainder N_l-1 arguments with $\sum_{j=1}^{N_l} q(n_{wj},n_{w-j})=1$

Letting n_{pr} be the fixed number of praetorians and n_{gl} the number of guards hired by lord l, the payoff of the lord can now be written:

$$(12)\qquad V_l = q(n_{wl},n_{w-l})N_p[p(x^*+f(n_{gl}/(q(n_{wl},n_{w-l})N_p)))-p(x^*)](1-x^*)$$

$$-(n_{wl}+n_{gl}+n_{pr})p(x^*)(1-x^*)$$

The main difference of (12) from Leviathan's payoff in (9) is the determination of the number of peasants: Whereas in (9) the chosen number of guards induces the number of peasants through $\nu(\cdot)$, here the number of peasants is determined by the number of warriors the particular lord has relative to other lords.

Initially, suppose the number of lords is given at $\bar{N}_l>1$. Then, a *short-run lordship regime* consists of numbers of peasants N'_p, bandits N'_b, and for each lord l guards n'_{gl} and warriors n'_{wl} such that:

(I) Each lord $l = 1,2,\ldots,\bar{N}_l$ takes N'_p as given and chooses n'_{gl} and n'_{wl} simultaneously with other lords so that these choices form a Nash equilibrium;

(II) $N'_b = \sum_{j=1}^{\bar{N}_l} n'_{bj}$ where for all j $n'_{bj} = q(n'_{wj},n'_{w-j})N'_p(1-p^j)/p(x^*)$

and $p^j \equiv p(x^*+f(n'_{gj}/(q(n'_{wj},n'_{w-j})N'_p)))$

(III) $N = \sum_{j=1}^{\bar{N}_l} n'_{gj} + \sum_{j=1}^{\bar{N}_l} n'_{wj} + \bar{N}_l n_{pr} + N'_p + \bar{N}_l + N'_b$

Part (I) is straightforward: The lords compete for "market share" through the hiring of warriors and the protection they provide to peasants, although each lord individually does not take account of his effect on the number of peasants. Part (II) states that the number of bandits equals the sum of the bandits in each lord's territory, and the number of bandits in each lord's territory is such that the utility of bandits and peasants is equalized. Clearly, the number of bandits in territory j is inversely related to the total protection level p^j and when there is perfect security ($p^j=1$) there are no bandits in territory j. Finally, part (III) is a "market clearing" condition, so that the Nash equilibrium choices of warriors and guards, the induced numbers of peasants and bandits, and the fixed numbers of praetorians and lords add up to the total population N.

The problem of existence of such a regime, although analogous to the problem of existence of competitive equilibrium in neoclassical economics, is nontrivial. The Proposition that follows provides information on existence, uniqueness, and characterization of the short-run lordship regime.

Proposition 3: *Suppose* q(·) *is concave in its first argument,* p(·) *is concave, and* *f(·) satisfies* (5).

(i) Then, each lord's payoff, V_l, *is concave in* n_{gl} and n_{wl} *and for any given* N_p *a Nash equilibrium in* n_{gl} and n_{wl} *exists.*

(ii) If the Nash equilibrium n_{wl}*'s and* n_{gl}*'s are continuous functions of* N_p *on the interval* $[0,N-\bar{N}_l(1+n_{pr})]$, *then a short-run lordship regime exists.*

(iii) Under any short-run lordship regime, each lord provides the same level of protection.

(iv) If the following condition is satisfied

(13) $$q(n_{wl},n_{w-l}) = h(n_{wl}) / [\sum_{j=1}^{\bar{N}_l} h(n_{wj})]$$ *where* h(·) *is a positive, increasing, and concave function*

a short-run lordship regime is unique in the number of lords and symmetric, whereby every lord chooses the same number of guards and warriors. In such regimes, (a) the number of peasants is strictly decreasing in the number of lords and (b) each lord's *payoff is strictly decreasing in the number of lords.* (the proof is in Appendix A.)

The sufficient condition for existence in part *(ii)* is analogous to the continuity of demand functions in the theory of competitive equilibrium. The properties of the short-run lordship regime in parts *(iv),(a)* and *(b)* are intuitively plausible. When an additional lord enters the fray, each lord would increase his number of warriors for a given number of peasants. Since the number of peasants is endogenous, however, their number should decrease in equilibrium with the total number of warriors increasing. A smaller number of peasants shared among a larger number of lords is eventually shown to also yield a smaller payoff for lords.

Additional properties would require employing specific functional forms. For example, consider the following special case of (13):[11]

$$q(n_{wl}, n_{w-l}) = n_{wl}^{\ m} / (\sum_{j=1}^{N_l} n_{wj}^{\ m}) \quad \text{where } 1 \geq m > 0$$

The parameter m is a measure of how easy it is for a lord to increase his dominion when he increases the number of warriors he hires by a small amount, the *effectiveness* of conflict. Then, under examples for other functions we employed earlier,[12] as the technology of conflict becomes more effective (m increases), the total number of peasants becomes smaller. It appears that this occurs because lords compete more intensely when conflict becomes more effective by hiring additional warriors, without however changing their share of peasants. The effect of this additional demand for manpower is to decrease the population pool from which the peasants are drawn. The end result of an increase in m is a smaller number of peasants, a larger number of warriors per lord, and a smaller number of guards per lord. Such an increase in m also reduces each lord's profits.

In the long-run lords should be allowed to exit and potential lords should be allowed to enter and establish their own state. Since lords come from the population, N, we suppose the long-run number of lords is determined by the reservation payoff in this economy, which is the peasant's payoff U^*_p ($=p(x^*)(1-x^*)$). There will be no incentive for lords to exit and potential lords to enter as long as the existing lords earn a payoff that is at least as high as that of peasants, and if an extra lord were to enter he would receive a lower payoff than that of peasants. Let $V^{N_l}_i$ denote an (equilibrium) payoff of lord $i = 1,2,\ldots,N_l$ under a short-run lordship regime with N_l lords. We then define a *long-run lordship regime* to be a short-run lordship regime (that satisfies (I)-(III)) and a number of lords N'_l such that

$$\text{(IV)} \quad V^{N'_l}_i \geq U^*_p \text{ for all } i=1,2,\ldots,N'_l \text{ and}$$
$$V^{N'_l+1}_i < U^*_p \text{ for at least one } i=1,2,\ldots,N'_l,N'_l+1$$

Proposition 4: *Suppose* $q(\cdot)$ *is concave in its first argument and satisfies* (13), $p(\cdot)$ *is concave, and* $f(\cdot)$ *satisfies* (5). *Furthermore, suppose that if only one lord were to exist, he would receive a higher payoff than a peasant. Then, (i) a unique (in the number of lords) and symmetric long-run lordship regime exists; (ii) the number of peasants and the output of such a long-run lordship regime approximates from above, respectively, the number of peasants and the output under anarchy; in particular:*

$$(14) \qquad N'_p = N^*_p + N'_l(V^{N'_l}_i - U^*_p)$$

Part *(ii)* of the Proposition states that output and the number of peasants is almost the same as those under anarchy. Free entry of lords essentially eliminates all the extra production that can be achieved by the use of the collective protection technology. What was previously taken by bandits under anarchy is now taken by praetorians, warriors, guards, lords, and, possibly, by bandits as well, without essentially affecting the total output that is produced. (If of course lords can extract more efficiently than bandits can, output could be even lower than anarchy.) Literal anarchy is replaced by a more organized, higher-level anarchy of predatory states.

V. Stability of political formations and the tragedy of coercion

Thus far we have examined four different types of the organization of protection - anarchy, self-governance, Leviathan, and competing lords - separately. Only in transitions between sections have we alluded to the possibility that one type of state organization would not be viable in the presence of another. Having gone through all the possible configurations, we can now consider more globally which political formation is more likely to emerge under which particular set of circumstances.

From the last section it appears that if the fixed cost of establishing a state were low enough and the technology of collective protection were sufficiently more efficient than private protection (so that the lords reap the rents created by the hiring of guards), the lordship regime would be the stable political formation that could be expected to emerge - anarchy or a single Leviathan would attract new entrants in the protection business.

It is not completely clear, however, that self-governance would not be viable since we have not specified a model which allows for the simultaneous presence of lords and self-governing states. With lords present, self-governing states must have warriors to defend themselves against being taken over by lords. Whereas, in a self-governing state each contributor to defense can appropriate only $1/k$ of the social benefits, Leviathan or a lord can appropriate the full benefits of such expenses. The free-riding incentives in voluntary contributions to military defense make self-governing states an easy prey for lords. But even without such free-riding in defense, we specify a model in Appendix B and show with functional forms we have used ealier in the paper that self-governing states would not be viable as their citizens would receive payoffs lower than those under lords or under anarchy. The peasants of such states would have to devote too many resources to defending themselves against lords to allow much for internal protection and production.[13]

Clearly, very low efficiency of collective protection or a complete absence of an advantage over private protection (as, for example, when $\beta=1$ in (6a)), would make all three types of state organization - self-governance, Leviathan, or competing lords - unviable, leaving anarchy as the stable political formation. Provided the technology of collective protection is efficient enough relative to private protection, self-governing states could survive when the fixed cost of praetorians is too high to yield a positive payoff for either a Leviathan or competing lords. When the fixed cost of praetorians is low enough for Leviathan to make positive profits but without making a long-run lordship regime viable, Leviathan becomes the stable political organization. Further decreases in the fixed cost would make competing lords the stable regime. The Table below summarizes the stable political formations under the different combinations of fixed cost and efficiency of collective protection, where the precise levels of these variables depend on other model features like population and the technology of conflict.

Table 1 about here

Even this simplified two-dimensional view of the factors that lead to a stable political formation can provide some insight into historical development. Two features that are present in the table are worth emphasizing. First, to have anything like a state emerge you need to have some advantage of collective protection over private protection. Such an advantage typically started to exist with the concentration of populations in permanent settlements which, in turn, became possible with the spread of agriculture.

Second, and in the presence of efficient forms of collective protection, declining fixed costs associated with the establishment of a predatory state lead first to a large number of small self-governing states, then to Leviathan, and then to an increasingly larger number of smaller lordships or predatory states. Thinking of the fixed cost as a portmanteau variable that captures not just literally the praetorian guard but broadly the organizational costs and knowhow for running a predatory state, we can reasonably argue that, once a particular organizational form is implemented, the fixed cost is high and can be incurred initially only by the innovator but gradually becomes smaller with time, and can be incurred by others, as the organizational innovation diffuses. Thus, organizational innovation of that sort first extinguishes self-governance, then abruptly leads to centralization, which then gradually fragments to ever smaller predatory states. That process can be held back by additional organizational and military innovation so that political fragmentation can be arrested temporarily.

The break from self-governance into a Leviathan can be discerned in at least one historical period: During the last four centuries B.C. in the Eastern Mediterranean. From about the eighth century B.C. onward, the Mediterranean Sea saw the emergence and proliferation of city-states, many of which could be classified as self-governing, especially in the later phases.[14] They were mainly Greek and Phoenician, but they also spread elsewhere. This process was arrested, however, by the Persian Empire in the east during the sixth century and, as mentioned earlier, by Philip and Alexander in Greece during the fourth century. Philip and Alexander made seemingly only incremental changes in the organization of the army and the state of Macedonia, but these were enough to overtake both the Greek city states and the Persian Empire itself. Those changes also remained with Alexander's successors, who were themselves overtaken in a couple of centuries by another dynamic military power, Rome, that had also made some incremental innovations. One victim of Rome's success in using the means of control was apparently the Roman Republic itself.

The successor to the Roman Republic, the Roman Empire, lasted for centuries but, in its western edges, the Germanic tribes were able to absorb some of its military and organizational competencies, challenge it, and in the West dissolve it. The smaller political formations that emerged, including the Germanic Holy Roman Empire, continued to become smaller and gave rise to the system of feudalism, whereby arguably the most basic political unit became very small. Thus, the history of the West up to the late Middle ages could usefully, but roughly, be characterized by a long, gradual reduction of the fixed costs of running a predatory state brought about by the diffussion of military and organizational knowhow. Associated with that reduction, as indicated in Table 1, was the abrupt passage from self-governance to Leviathan, and then a gradual decline in the size and an increase in the number of states. (What followed afterwards in the West probably cannot fit neatly with this simple story. Other parameters, especially those involving military technology, would have to be included.)

What needs emphasis, however, is that once Leviathan appears and becomes viable the floodgates of coercion open and what comes next, as we have seen in the case of competing lords, can be even worse, thus leading to a *tragedy of coercion*. And this is not an issue that concerns just the past. Nowadays, a large majority of the earth's population lives under autocratic or openly coercive regimes, with some societies deteriorating to Hobbesian conditions. The power vacuum that may appear anywhere from American inner cities, to the Caucasus, Colombia, or Somalia is not typically filled by self-governing alliances, democratically elected leaders, or even benevolent dictators, but is instead contested by rival gangs, mafias, and warlords with little hope of resolution in the near or medium term. Although we do not provide recipes for bettering such a condition, our framework at least helps us to begin understanding why it occurs.

VI. Concluding Comments

We have examined the provision of protection within a simple and stark context. The framework we have employed has allowed us to make inferences both about the internal organization of the political formations that could emerge and about their market structure. While self-governance yields higher welfare for predator and prey alike, the small size of self-governing political formations along with the coercive machinery that can be employed by predatory states makes the long-run viability of self-governance problematic. Hence hierarchy and predatory behavior towards subjects is the more stable form of internal organization; and competition among such states for the rents thus created is the dominant market structure. But, contrary to ordinary economic markets, the more competition there is in the market for protection, the worse it is - competing lords and their entourages extract what would have been taken in their absence by simple bandits.

This occurs when one considers the inner layer of state functions, stripped of the provision of ordinary infrastructural public goods and in the absence of the multitude of legal codes, constitutions, ideologies, and norms that govern most of today's states. In much of economics these outer layers of the state have been taken for granted, a practice that in the somewhat tranquil post-World War II period may have been harmless and even useful for understanding economic behavior in industrialized countries. But the inner layers of the state have always been making their ugly presence felt in much of the developing world and now they are systematically confronting transition economies. Ignoring the fundamental problem in providing security and protection, and treating systematic deviations from ideal notions of the state as aberrations would not appear to be a fruitful attitude. Looking into the inner layers of the the state is a comparatively easy task, because of their starkness and relatively simplicity. Understanding how the outer layers of the modern state, including representative democracy, have appeared among seas of coercive governance appears to be a more difficult task.

APPENDIX A

We will employ Claim 1 in the proof of part *(i)* of Proposition 3.

Claim 1: $A(z) \equiv p(x^*+f(z)) - p(x^*) - p'(x^*+f(z))f'(z)z > 0$ for all $z \in [0,1]$ when $p(\cdot)$ is concave and $f(\cdot)$ is strictly concave.

Proof: Since $p(0) = 0$ and $p(\cdot)$ is concave we have $[p(x^*+f(z))-p(x^*)]/f(z) \geq p'(x^*+f(z))$. Therefore, substitution yields:

$$A(z) \geq p'(x^*+f(z))\ [f(z) - f'(z)z]$$

Since $f(0) = 0$ and $f(\cdot)$ is strictly concave we also have $f(z)>f'(z)z$. Hence the term inside the brackets in the right-hand-side of the inequality is positive which, together with the positivity of $p'(x^*+f(z))$, implies $A(z)>0$.■

Proof of Proposition 3: *Part (i).* For compactness, let $q^1 = q(n_{w1},n_{w-1})$, $p = p(x^*+f(n_{g1}/(q(n_{w1},n_{w-1})N_p)))$, and $f = f(n_{g1}/(q(n_{w1},n_{w-1})N_p))$. Then, V_1 in (12) is as follows:

$$V_1 = q^1N_p[p-p(x^*)](1-x^*)-(n_{w1}+n_{g1}+n_{pr})p(x^*)(1-x^*) \tag{12}$$

To show the concavity of V_1 in n_{w1} and n_{g1}, we will show that the Hessian of V_1 (w.r.t. those two variables) is negative definite. Letting q^1_1 and q^1_{11} denote the first and second partial derivatives of q^1 with respect to its first argument (n_{w1}), successive differentiation of V_1 yields:

$$\partial V_1/\partial n_{w1} = (1-x^*)\{(q^1_1/q^1)\ [q^1N_p(p-p(x^*))-p'f'n_{g1}] - p(x^*)\}$$

$$\partial V_1/\partial n_{g1} = (1-x^*)(p'f' - p(x^*))$$

$$\begin{aligned}\partial^2 V_1/\partial n^2_{w1} &= (1-x^*)\{(q^1_{11}q^1N_p/q^1)\ [(p-p(x^*))-p'f'(n_{g1}/q^1N_p)] \\ &\quad + (q^1_1)^2N_p[p''(f')^2+p'f''][n_{g1}/(q^1N_p)]^2\} \\ &= (1-x^*)\{(q^1_{11}q^1N_p/q^1)\ A + (q^1_1)^2N_p[n_{g1}/(q^1N_p)]^2\ B\}\end{aligned} \tag{A1}$$

where $A \equiv (p-p(x^*))-p'f'(n_{g1}/q^1N_p)$ and $B \equiv [p''(f')^2+p'f'']$

$\partial^2 V_1/\partial n^2_{w1} = (1-x^*)B/(q^1N_p)$ and

$\partial^2 V_l/(\partial n_{wl}\partial n_{gl}) = -Bq^1_1 N_p$

Note that A is the same as A(z), defined in Claim 1, with $z = n_{gl}/(q^1 N_p)$. By Claim 1, then, A is positive. Since p(•) is concave and f(•) is strictly concave, B, as defined above, is negative. Finally, since q is concave in its first argument, q^1_{11} is non-positive. Altogether, those properties readily imply the negativity of both $\partial^2 V_l/\partial n^2_{wl}$ and $\partial^2 V_l/\partial n^2_{gl}$. Consequently, the determinants of the first principal minors of the Hessian of V_l are negative, as is necessary for the concavity of V_l.

The determinant of the Hessian itself is $\bar{H} = [\partial^2 V_l/\partial n^2_{wl}][\partial^2 V_l/\partial n^2_{gl}] - [\partial^2 V_l/(\partial n_{wl}\partial n_{gl})]^2$ which, given the calculations above, can be shown to equal $(1-x^*)q^1_{11}AB/q^1$. Given that $q^1_{11}<0$. $A>0$, and $B<0$, that deterninant is positive. It follows that the Hessian of V_l is negative definite and, therefore, V_l is concave in n_{wl} and n_{gl}. Then, for the given number of lords, $\bar{N}_l$, and a number of peasants N_p, a Nash equilibrium exists.

Part (ii): Let $g_l(N_p)$ and $w_l(N_p)$ denote the continuous functions mentioned in the "if" part of *(ii)*'s statement. Then, note that the induced number of bandits for any given N_p, and assuming the lords play Nash equilibrium strategies that induce $g_l(N_p)$ guards and $w_l(N_p)$ warriors for lord l, is a function $B(N_p) = \sum_{l=1}^{\bar{N}_l} b_l(N_p)$ where $b_l(N_p)$ is the induced number of peasants in lord l's territory. Because $b_l(N_p)$ is a continuous function of the numbers of guards and warriors (compare with part II of definition of short-run lordship regime), $B(N_p)$ is a continuous function as well.

Thus far, we have shown that, for a given N_p, the induced guards $g_l(N_p)$, warriors $w_l(N_p)$ for $l=1,\ldots,\bar{N}_l$, and the induced number of bandits, $B(N_p)$, satisfy parts I and II of the definition of the short-run lordship regime. To show the existence of that regime, then, amounts to showing the existence of an N'_p that induces numbers of guards, warriors, and bandits that satisfy the following version of part III of the regime's definition:

$$[N - \bar{N}_l(1+n_{pr})] = \sum_{l=1}^{\bar{N}_l} g_l(N'_p) + \sum_{l=1}^{\bar{N}_l} w_l(N'_p) + N'_p + B(N'_p)$$

or, that the function $H(N_p) \equiv \sum_{l=1}^{\bar{N}_l} g_l(N_p) + \sum_{l=1}^{\bar{N}_l} w_l(N_p) + N_p + B(N_p)$ has a point in its domain, N'_p, such that $H(N'_p) = [N - \bar{N}_l(1+n_{pr})]$. Now, note that for $N_p=0$ it is optimal for every lord to choose no guards or warriors and thus have $g_l(0) = w_l(0) = 0$. Similarly, since without any peasants around being a bandit provides zero payoff, we must have $B(N_p) = 0$. Hence, we have $H(0) = 0$. Next, note that, since the numbers of guards, warriors, or bandits cannot be negative $H(N-\bar{N}_l(1+n_{pr})) \geq N - \bar{N}_l(1+n_{pr})$. These two properties along with the continuity of $H(\cdot)$ imply the existence of the N'_p we were looking for, with $n'_{wl} = w_l(N'_p)$, $n'_{gl} = g_l(N'_p)$, and $N'_b = B(N'_p)$.

Part (iii): Consider a short-run lordship regime. The same level of protection would be provided by each lord if $p[x^*+f(n'_{gl}/(q^l N'_p))]$ were to be identical for all $l=1,\ldots,\bar{N}_l$ or, given the costliness of guards and warriors, if $z^l \equiv n'_{gl}/(q^l N'_p)$ were also to be identical across lords. First note that $\partial V_l/\partial n_{gl}$ evaluated at $n_{gl}=0$ equals $(1-x^*)(p'(x^*)f'(0) - p(x^*)) = (1-x^*)(p'(x^*)f'(0) - p'(x^*)(1-x^*)) = (1-x^*)p'(x^*)(f'(0) - (1-x^*))$ which is positive since the concavity of $f'(\cdot)$ along with $f(0)=0$ imply $f'(0) \geq 1 > 1-x^*$. In turn, this property implies that n'_{gl} is always positive for all l. Therefore at the lordship regime values, we must have either

$\partial V_l/\partial n_g = (1-x^*)[p'(x^*+f(z^l))f'(z^l) - p(x^*)] = 0$, or

$p(x^*+f(z^l)) = 1$ (where in the latter case $\partial V_l/\partial n_g$ evaluated at z^l would be positive). The solution in terms of z^l, because $f(\cdot)$ is strictly concave and $p(\cdot)$ concave, is in either case unique and identical across the different lords. Therefore, each lord provides the same level of protection.

Part (iv): We first show symmetry and then uniqueness. Consider any short-run lordship regime and let "′" over a variable denote the value of the variable under that regime. From part *(iii)* we know that $z^l \equiv n'_{gl}/(q^l N'_p)$ and $p(x^*+f(z^l))$ take the same values for all lords. Therefore, $A \equiv p(x^*+f(z^l)) - p(x^*) - p'(x^*+f(z^l))f'(z^l)z^l$ is identical across the different lords. Then, we can write:

$$\partial V_l/\partial n_{wl} = (1-x^*)[q_1^l N_p A - p(x^*)]$$

Note that these derivatives can be different across lords (and, for the same lord, across different points) only by the value of $q_1^l = \partial q(n_{wl}, n_{w-l})/\partial n_{wl}$. By the contest success function in (13), it can be shown that

(A2) $$q_1^l = h'(n_{wl})[\sum_{i\neq l} h(n_{wi})]/[\sum_{all\ i} h(n_{wi})]^2$$

Consider any two lords j and k and suppose, contrary to what we want to show, that $n'_{wj} > n'_{wk}$ (≥ 0). Then, by the concavity of the payoff functions, the relationship between these two lords' partial derivatives, each evaluated at the lord's regime point, must be as follows:

$$\partial V_k/\partial n_{wk} \leq \partial V_j/\partial n_{wj} = 0$$

In turn, from the above this relationship implies $q_1^k \leq q_1^j$ or, given (A2),

$$h'(n'_{wk})[\sum_{i\neq k} h(n'_{wi})]/[\sum_{all\ i} h(n'_{wi})]^2 \leq h'(n'_{wj})[\sum_{i\neq j} h(n'_{wi})]/[\sum_{all\ i} h(n'_{wi})]^2$$

Since the denominators of the two expressions are identical, we also have

(A3) $$h'(n'_{wk})[\sum_{i\neq k} h(n'_{wi})] \leq h'(n'_{wj})[\sum_{i\neq j} h(n'_{wi})]$$

Since, by supposition, $n'_{wj} > n'_{wk}$ we have $\sum_{i\neq k} h(n'_{wi}) > \sum_{i\neq j} h(n'_{wi})$ and, by the concavity of $h(\cdot)$, $h'(n'_{wk}) \geq h'(n'_{wj})$. These two inequalities, taken together, contradict (A3). Therefore, our original supposition $n'_{wj} > n'_{wk}$ is false. By a similar argument we can show that $n'_{wj} < n'_{wk}$ cannot be true either. Hence, we must have $n'_{wj} = n'_{wk}$ for any two lords j and k. This property, in turn, implies that $q^j N_p = q^k N_p$ and, given that $z^j = z^k$, we also have $n'_{gj} = n'_{gk}$. This establishes that any lordship regime is symmetric.

To show uniqueness, let n'_w and n^2_w denote the choices of warriors associated with two different regimes and w.l.o.g. suppose $n^2_w > n'_w$ (≥ 0). Then, the following relationships would hold between the pairs of derivatives:

$$\partial V'_l/\partial n_{wl} \leq \partial V^2_l/\partial n_{wl} = 0 \;\Rightarrow\; q_1^{l'} \leq q_1^{l2}$$

$$\Rightarrow\; h'(n'_w)/h(n'_w) \leq h'(n^2_w)/h(n^2_w)$$

But the concavity of $h(\cdot)$ along with $n^2_w > n'_w$ contradict this last inequality.

Therefore our initial supposition of two different short-run lordship regimes must be false; there is only one symmetric regime.

Part (iv), (a): We have just shown that a unique and symmetric short-run lordship regime exists for any given number of lords. The number of peasants in such a short-run lordship regime is:

(A4) $$N_p = N - N_b - N_l(1 + n_{pr} + n_w + n_g),$$

where all variables are assumed to be at the regime values. From the proof of part *(iii)*, it can be shown that, regardless of N_l,

(A5) $$n_g = \gamma(N_p/N_l) \text{ for some } \gamma>0.$$

That property also implies that the same level of protection is provided across different regimes, that $\bar{p} \equiv p(x^*+f(z))$ does not vary across regimes (and depends only on the technologies of private and collective protection). In turn, that property along with condition (II) implies that the number of bandits is related to the number of peasants as follows:

(A6) $$N_b = [(1-\bar{p})/p(x^*)]N_p.$$

Using (A5) and (A6), we can eliminate n_g and N_b from (A4), which after re-arranging can be written as:

(A4') $$CN_p + N_l(1 + n_{pr} + n_w) = N \quad \text{where } C\equiv[1-\bar{p}+p(x^*)(1+\gamma)]/p(x^*)$$

If n_w were 0, an increase in the number of lords, N_l, would clearly lead to a reduction in the number of peasants, N_p. Thus, for the rest of this proof we assume an interior (Nash equilibrium) choice of guards ($n_w>0$). Then, the first-order condition of the symmetric equilibrium under (13) implies:

(A7) $$h'(n_w)/h(n_w) - N_l^2 d/[N_p(N_l-1)] = 0 \quad \text{where } d\equiv1-\bar{p}+p(x^*)(1+\gamma)$$

N_p and n_w are simultaneously determined through (A4') and (A6) and a change in the number of lords also changes the values of these variables. Although we define lordship regimes for integer values of N_l, (A4') and (A6) are defined for real values of N_l. Moreover these functions are differentiable and in N_l, as well as N_p and n_w, and the conditions for an implicit function theorem are satisfied. The marginal effect of N_l on N_p can then be shown to be:

(A8) $$\partial N_p/\partial N_l = (1/D)[-(1+n_{pr}+n_w)HN_p(N_l-1)+ dN_l^2(N_l-2)/(N_l-1)]$$

where $D = (d/p(x^*))HN_p(N_l-1) - N_l(N_l-1)dh'(n_w)/h(n_w)$ which is negative since $H = h''(n_w)/h(n_w) - [h'(n_w)/h(n_w)]^2 \leq 0$ (it is the second derivative of the first argument of q(•) which, by assumption, is concave). Since H is non-positive the term of $\partial N_p/\partial N_l$ inside the brackets is positive and, since D is negative, the effect of an increase in the number of lords on the number of peasants must be negative.

Part (iv), (b): Next we seek to show that each lord's payoff is strictly decreasing in the number of lords. Note that in the symmetric regime the payoff of each lord is as follows:

$$V_l = [\text{Total output} - (N_p+N_b+N_w+N_g+N_{pr})p(x^*)(1-x^*)]/N_l$$

$$= [N_p(1-x^*) - (N-N_l)p(x^*)(1-x^*)]/N_l$$

$$= (1-x^*)(N_p+p(x^*)N_l-p(x^*)N)/N_l$$

(A9) $$= p(x^*)(1-x^*) + (N_p-N_p^*)/N_l$$

Since $p(x^*)(1-x^*)$ and N_p^* are constant and and we have just shown that N_p depends negatively on N_l, V_l must also be strictly decreasing on N_l. ∎

Proof of Proposition 4: *Part (i)*: By the assumptions stated in the Proposition, which are the same as those of Proposition 3, part (*iv*), a short-run lordship regime exists for any number of lords, which is unique and symmetric – in particular all lords receive the same payoff. Moreover, by part (*iv*) (*b*) of Proposition 3, the lords' payoff is strictly decreasing in the number of lords. For sufficiently small n_{pr} and with $V^l(N_l=1) \geq U_p^*$, there is a number of lords that yields a lord's payoff higher than that of a peasant (which equals U_p^*). In addition, we can always find a large enough number of lords (say, N) that yields a payoff to a lord that is lower than U_p^*. Then, since the lords' payoff is strictly decreasing in the number of lords, there must exist a unique number of lords, N'_p, that satisfies condition (IV). Therefore, a unique long-run lordship regime exists.

Part (ii): Total output is proportional to the number of peasants (it equals $N_p(1-x^*)$), so we only need consider the number of peasants. From (A9), we have $V_l^{N'_l}-U^*_p = (N'_p-N^*_p)/N'_l$. Solving for N'_p in terms of the other variables yields equation (14) in the main text. Since the payoff of lords is strictly decreasing in the number of lords and, by the definition of a long-run lorship regime, $V_l^{N'_l}-U^*_p$ should be typically rather small, the number of peasants approximates from above the number of peasants under anarchy. ∎

APPENDIX B

On Integrated Equilibrium with Lords and Self-Governing States

In this Appendix we show how self-governing states cannot in general co-exist in the presence of predatory states that are run by lords, even when there is no free-rider problem in providing for defense against other states. We therefore substantiate the informal claim we make in section V of the paper. We first define an appropriate notion of short-run equilibrium that allows for both lords and self-governing states to co-exist. We then show that, under the examples we have used in various parts of the paper, the equilibrium payoff of peasants belonging to a self-governing state would always fall short of the payoff a peasant could receive in anarchy or under a lord (when $p(x)=\rho(x)$). Thus, it would not be profitable for such a state to form and a long-run equilibrium with self-governing states would not exist.

Suppose there are $\bar{N}_l>1$ lords and a number $S\geq1$ of self-governing states with k peasants each. The lords behave as in section IV and their payoff functions are as in (12) (except for the slight modification of $q(\cdot)$ below, which has to take account of the warriors of self-governing states). Peasants in self-governing states, in addition to contributing to private and collective protection need to contribute to fighting for their independence by spending some of their time as warriors. Let w_k denote the total resources spent on fighting by state $k \in \{1,2,\ldots,S\}$. We suppose that each citizen-peasant contributes an equal portion, w_k/k, to fighting; contributions to private and collective protection are as before voluntary. Thus, the payoff of a peasant-citizen is:

$$(1'') \qquad U_{pi} = p(x_i + f(z))(1 - x_i - z_i - w_k/k) \qquad [z = \sum_{j=1}^{k} z_j/k]$$

To maintain their independence, the citizens of state $k \in \{1,2,\ldots,S\}$ have to expend effort on war, w_k, so that

$$(\text{B1}) \qquad q(w_k, w_{-k}, \bar{n}_w)N_p = k$$

where w_{-k} is the vector of war efforts by all the other self-governing states, $\bar{n}_w$ is the vector of warriors of all the lordships, and $q(\cdot)$ is the contest success function defined in (11) and appropriately modified to include the war effort of the self-governing states. We are now ready to define an appropriate notion of equilibrium for these states, which is an extension of the short-run lordship regime defined in section IV.B.

A *short-run integrated equilibrium* consists of numbers of peasants N'_p, bandits N'_b; for each lord l guards n'_{gl} and warriors n'_{wl}; for each self-governing state k a war effort w'_k; and for each citizen-peasant in self-governing states choices of private and collective protection such that:

(Ia) Each lord $l = 1,2,\ldots,\bar{N}_l$ takes N'_p and the w'_ks as given, and chooses n'_{gl} and n'_{wl} simultaneously with other lords so that these choices form a Nash equilibrium;

(Ib) Each self-governing state $k=1,2,\ldots,S$ chooses w'_k so that (B1) is satisfied;

(Ic) Each citizen-peasant takes w'_k as given and chooses private and collective protection levels so that they form a Nash equilibrium;

$$(\text{II}) \quad N'_b = \sum_{j=1}^{\bar{N}_l} n'_{bj} + \sum_{k=1}^{S} n_{bk} \quad \text{where for all j } n'_{bj} = q_j N'_p (1-p^j)/p(x^*),$$

for all k $n_{bk}=kp^k/p(x^*)$; and p^j and p^k are the shares of output kept away from bandits in lordship j and self-governing state k;

$$\text{(III)}\quad N = \sum_{j=1}^{\bar{N}_1} n'_{gj} + \sum_{j=1}^{\bar{N}_1} n'_{wj} + \bar{N}_1 n_{pr} + N'_p + \bar{N}_1 + N'_b + Sk$$

We will now derive the integrated equilibrium under the following functional forms: $p(x)=x$, $f(z)=z^{1/2}$, and the modification of (13) where the share of peasants of lordship j is $q_j = n_{wl}/(\sum_{j=1}^{\bar{N}_1} n_{wj} + \sum_{k=1}^{S} w_k)$.

It can be shown that lords choose to provide perfect security and all choose the same number of guards $n'_{gl}=(N'_p-Sk)/4\bar{N}_1$. Lords also choose the same equilibrium number of warriors $n'_{wl}=(N'_p-Sk)(\bar{N}_1-1)/2\bar{N}_1^2$. All the self-governing states choose war effort $w'= k(\bar{N}_1-1)/2\bar{N}_1$. (Note that the per-peasant contribution to war effort, w'/k, is at least 1/4 and can be as high as 1/2.) In turn, all citizen-peasants choose contributions to collective production of $z'=1/4k^2$ and private protection of $x'=(4k^2-2k-1-4w'k)/8k^2$ where w' has the value just derived above. The equilibrium payoff of citizen-peasants can be found by substituting w'/k, x', and z in (1″), and it equals

$$\text{(B2)}\quad U'_p = [4k^2+2k-1-2k^2(N_1-1)/N_1]^2/16k^4.$$

We are interested in comparing this equilibrium citizen-peasant payoff to that of a peasant under a lord, which (since $p(x)=\rho(x)$) also equals the peasant's payoff under anarchy, $p(x^*)(1-x^*)$. Under the example we are examining this payoff is 1/4, which we need to compare to U'_p in (B2). Straightforward algebra shows that $U'_p<1/4$ is equivalent to

$$\text{(B3)}\quad 2k-1 < 2k^2(N_1-1)/N_1$$

Since $N_1>1$, we have $(N_1-1)/N_1>1/2$; in addition, as $k\geq\bar{k}\geq2$, $k^2\geq2k$ for all k. Put these two inequalities together, we obtain $2k^2(N_1-1)/N_1 > 2k > 2k-1$. Therefore (B3) is always true, and thus *a citizen-peasant's payoff under a short-run integrated equilibrium is always lower than the payoff of a peasant under a lord or under anarchy.* Consequently, there would be no incentive to form a self-governing state under such circumstances and thus self-governance could not be viable in the long-run.

The burden of defense against other states, imposes such a cost on the individual citizen-peasants so that there are not many resources left for internal protection against bandits and for production.

We should emphasize that we do not completely rule out the possibility of self-governing states being able to survive under some set of functional forms or, especially, if the model were to be appropriately modified to provide advantages to self-governance. We have not being able however to discover any functional forms that would allow this to occur. We consider then our counterexample to the co-existence of self-governance and lordships and our inability to find any examples in which this can occur as strong theoretical evidence for the difficulty of self-governance surviving in the presence of predators. Of course, discovering conditions in other models that would yield the viability of self-governance is an important topic for future research.

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FOOTNOTES

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[1] A very small subset of the related literature includes Franz Oppenheimer, 1971; Friedrich Engels, 1973; Gordon Tullock, 1974; Douglass North, 1981; Tilly, 1992. Later on we will discuss the relation to a small literature in economics.

[2] Two recent additions to the literature are Boaz Moselle and Ben Polak (1997), who also show how a Leviathan can be even worse than anarchy, and Ronald Wintrobe (1998) who provides perhaps the most in-depth economics analysis of autocracy to date. Earlier work (Jack Hirshleifer, 1988, 1995; Stergios Skaperdas, 1992) had examined more closely anarchic settings. Another related area of research from economics is on the determinants of the size of states (David Friedman, 1977, Donald Wittman, 1991, Marc Artzrouni and John Komlos, 1995, Findlay, 1996). Our approach adds to this literature by deriving the determinants of size, as well as type, from an explicit optimizing model (Findlay also does this for a single state, an empire).

[3] Note that the share of output kept by a peasant does not depend on N_b and N_p. As our model becomes considerably more complicated in several other dimensions later, this assumption simplifies our analysis by making x^* independent of the numbers of bandits and peasants. We have not found this simplification to change our qualitative results and the property of independence of x^* continues to hold if the share of output kept by the peasant were to be specified as $p(x, N_p/N_b) = r(x)\gamma N_p/N_b$, where $r(\cdot)$ is and increasing function and γ is a positive parameter.

[4] We should mention that the function $p(x)$ could take a probabilistic interpretation, denoting the probability of the peasant prevailing in a conflictual encounter with a bandit and provided that conflict would not lead to the destruction of any output. Given the risk neutrality assumed of the two types of agents in (1) and (2), a peasant and a bandit would be indifferent between such conflict and dividing output with $p(x)$ going to the peasant and the remainder going to the bandit.

[5] To avoid unnecessary complications we allow for non-integer numbers of peasants and bandits. This could allow for part-time banditry, as Grossman (1991, 1994) allows for a single person to allocate time between farming, banditry, and soldiering.

[6] It should be mentioned that some authors (e.g., Michael J. Taylor, 1976, Ch.7) use the term "anarchy" to denote what we call self-governance. Etymologically this is also correct usage, but we would like to distinguish between the two possible types, and we have followed the more recent practice of identifying anarchy with a Hobbesian state of nature.

[7] For this result we assume implicitly that contributions to collective protection are contributions to a publicly provided private good, as the benefits of collective protection are rival with respect to an additional peasant. If peasant $k+1$ joins the group of previously k peasants but makes contributions lower than those of the average contribution of other members, the benefits of collective protection for all members are reduced. Qualitatively similar results would obtain if z were a congested public good, provided that the congestion cost is sufficiently convex.

[8] According to Diamond (1997), small self-governing societies with individual or collective protection were overcome by chiefdoms, the early forms of state, about 5,500 B.C. in Mesopotamia, and by 1000 B.C. in Mesoamerica. In these times a new technology of governance was developed. This technology included the disarming of peasants, arming a small elite, and monopolizing force to maintain public order and to curbe violence.

[9] Perhaps the most detailed model of a monopolist for-profit state can be found in Wintrobe (1998), in which in addition to repression expending resources to increase the loyalty of subjects is examined.

[10] It can be shown that when Leviathan *cannot* extract as easily as bandits can (i.e., $\rho(x) > p(x)$) is the only case in which peasants would be better off under Leviathan than under anarchy. Grossman (1998) also finds conditions that lead to a similar finding (it occurs when bandits can take a lot from peasants.) For our case, we cannot think of circumstances that would lead bandits to be better at extraction than Leviathan.

[11] Hirshleifer (1989) has examined the properties of this functional form; Skaperdas (1996) has axiomatized it as well as the more general form in (13).

[12] That is, under $p(x)=x$ and the technology of collective protection in (6a) the total number of peasants equals

$$N'_p = \frac{2^{1/\beta}\bar{N}_l[N-\bar{N}_l(1+n_{pr})]}{\bar{N}_l(1+2^{1/\beta})+(\bar{N}_l-1)2^{1/\beta}m(1-\beta)}$$

[13] However, we do not deny the possibility that self-governing states and lords could co-exist under some circumstances. In fact, we consider this an important topic for future research, but we suspect it would require the specification of an enriched model that cannot be accommodated within this paper.

[14] Here, as well as elsewhere, by the term self-governance we do not imply the absence of hierarchy or political oppression. Self-governance and a Leviathan's absolute rule are both ideal types that can hardly be literally true by any past or existing political formation. Thus, the contrast here between the two should not be considered an absolute one. The early Roman Republic, for example, was a stratified and oligarchic political system that was closer to self-governance and much farther from Augustan rule which can be likened to Leviathan, although there were many checks on the Emperor's rule, from the Senators to the Roman legions.

Fixed cost (n_{pr}) / efficiency of collective protection	High	Medium	Low
Very low	Anarchy	Anarchy	Anarchy
Higher	Self-governance	Leviathan	Competing Lords

Table 1