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A MODEL OF A PREDATORY STATE

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Abstract

We provide a model of a primitive state whose rulers extort taxes for their own ends. This 'predatory' state can result in lower levels of both output and popular welfare than either organized banditry or anarchy. The predatory state may provide public goods, such as protection or irrigation, and hence may superficially resemble a contractual state. But, the ability to provide such goods can actually reduce popular welfare after allowing for tax changes. We compare the revenues raised by taxation with those from banditry to get an idea when primitive states are likely to emerge.

We then consider interactions between bandits and the state. 'Corrupt' side-deals are bad for output and popular welfare, but good for revenue. Even in the absence of such collusion, the existence of a 'mafia' and of the state can be good for each other. Competition between organized crime and the state, however, typically reduces popular welfare and pushes the volume of banditry close to its anarchy level. Finally, we extend the basic model to allow the populace to form expectations of tax set by a long-lived king. Our relatively pessimistic conclusions about predatory states extend to this dynamic setting.

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Introduction

Archeologists and historians, regardless of the millennium or the continent they study or of their political or methodological persuasion, have tended to see the primitive state as a good thing. A visit to the Mesopotamian collection in the British Museum leaves the impression that the states of Ur or of Babylon marked high points of mankind's achievement, while the periods between empires were temporary set backs.[1] Similarly, for many historians of medieval Europe, "[t]he end of Antiquity was an unimaginable disaster, the holocaust of civilization itself".[2] Marc Bloch, of the French Annales school, argued that the evolution of western Europe could not recommence before order had been restored by the state.[3] Perry Anderson, a Marxist historian, describes the period between the Roman and Frankish empires as "chaotic and primitive centuries", whereas feudal authority in the high middle ages "produced a unified and developed civilization that registered a tremendous advance on the rudimentary, patchwork communities of the Dark Ages".[4] Nineteenth century Europeans attributed what they saw as disorder in Africa, in part, to statelessness, thus justifying the imposition of external authority. In response, until recently, African historiography has been dominated by searches for and studies of pre-colonial states.[5] This history has been the object of some pride with several modern African nations adopting the names of pre-colonial states.[6]

Great civilizations leave great relics. Thus, we know of the splendor at the courts of Hammurabi, Charlemagne, or Osei Bonsu.[7] We know far less, however, about the welfare of ordinary people under great states. Moreover, we do not know much at all about stateless societies. Records tend to be kept by states, and these typically claim that conditions were harsher in the less complex societies they replaced. But, since it is always in the interest of

[1] At the time of writing, these collections are displayed in rooms 55 and 56, best reached from the North entrance.

[2] The quotation is Anderson's (1974a p.129) summary of the view of Ferdinand Lot, a leading inter-war authority of the early middle ages. For a more modern and much more optimistic view of the 'dark ages' see, for example, Gies & Gies (1994).

[3] Bloch (1961). See, especially, vol 1 part 1.

[4] Anderson (1974a) p.137, and p.183. However, consistent with the line of this paper, Anderson sees the main advance as agricultural output, not necessarily popular welfare. He even suggests that the welfare of the peasantry may have been worse where and when state power was more developed (pp. 160-1).

[5] See, for example, the focus on states in the pre-colonial sub-saharan chapters of Fage's (1995) textbook, pp.322-3, offers a typically pro-state view. Works such as these have shattered the old view that Africans had no history, but in doing so they implicit accept the notion that a history is a history of states.

[6] Examples include Ghana, Mali, and Zimbabwe. Benin did not even lie within the modern boundaries.

[7] For descriptions of the latter's palace in Kumasi, see Wilks (1975) pp. 376-8.

state regimes to foster that impression, there are grounds for skepticism.

In this paper, we argue that the primitive state may have been a bad thing. To do so, we provide simple models of anarchy, of organized banditry and of a state. We can think of the former as a 'state of nature' and of the second as a society in which groups of raiders are relatively organized (the Vikings might be an example) but in which the settled population lack the kind of hierarchies or structures we associate with a state. By contrast, our state will have some minimal organization, notably a 'king'. The model allows us explicitly to compare the state with stateless societies in terms of both the quantity of output and its distribution between the rulers and the populace. Loosely speaking, in the model, the primitive state tends to result in lower levels of popular welfare than exist under organized banditry, or even under anarchy. In some cases, our state can even increase disorder and decrease total output. In his recent Kuznets lectures, Lucas (1996) asks why living standards were so low for so much of human history. We suggest that the blame may lie with the state.

In part, historians optimistic views of the state come, in the absence of evidence, from the theories of the state they have in the back of their minds. Theories of the state might address three issues. They might seek to explain the existence of the state, perhaps by some quasi-historical account of its origin. They might give a normative account of the state; that is, seek to legitimize the authority of the state. Finally, they might discuss the consequences of the state; that is, provide a model of the state. By far the most influential theory of the state, the contractual theory, does all three of the above.

In the typical contractual account, individuals live initially in a state of anarchy, and club together for protection. Economies of specialization lead to the hiring of agents to carry out this task, while economies of scale lead to the formation of (local) monopoly defence organizations. These 'protective associations' can be identified as (minimal) states.[8] For Hobbes and Locke (and, more recently, for Nozick), the main purposes of such an account are to justify and (perhaps) to limit the obligation of citizens to obey the state.[9] Contained in these accounts, however, is also an implicit model of what the state does. Typically, the state provides certain services to its citizens, especially protection and the preservation of order. In return, citizens provide payments to their king or lord, perhaps in the form of taxes or feudal dues. Different contractual theories differ in the obligations both of the state and of its citizens. How good a contractual state is for the populace depends in part on the terms of this contract but, even in Hobbes's least restricted of contractual states, life is

[8] For example, see Nozick (1974) pp. 16-17.

[9] See Hobbes (1968), Locke (1967) and Nozick (1974). For recent discussions of contractualism in Hobbes, see Ryan (1996), and Tuck (1996); and, in Locke, see Lloyd Thomas (1995).

preferable to that in his picture of anarchy. Indeed, if the supposed contract is agreed to by the populace as a whole, then they can not be worse off under the state than under anarchy: their well-being were they to reject the contract places a lower bound on their well-being were they to accept.[10]

As an explanation of the state, contractualism has suffered from historical criticism.. As early as the 1740s, Hume wrote: "[a]lmost all governments, which exist at present or of which there remains any record in story have been founded either originally on usurpation or conquest, or both, without any pretence of a fair consent, or voluntary subjection of the people".[11] As a justification for obeying the state, contractualism has suffered the criticism that people can not be bound by a contract to which they did not consent.[12] As a model of the state, however contractualism has refused to die. In particular, it continues to underlie historians' optimistic descriptions and assessments both of the state and of state-like institutions. For example, North & Thomas (1971, p.778) write that "[s]erfdom in Western Europe was essentially a contractual arrangement where labor services were exchanged for the public good of protection and justice".[13] North's (1981) "neoclassical" model of the state is still contractual at heart: "the state trades a group of services, which we shall call protection and justice, for revenue" (p.23). More recently, Gambetta (1993) has constructed a contractual model of the mafia, seen as an organization providing protection for revenue in competition with, or in place of, the state.

Unlike contractual accounts, this paper does not claim to explain the existence or seek to legitimize the power of the state or its rulers, but only considers its consequences. That is, we have no theory, only a model of the state. Like contractual accounts, this paper too compares the state with stateless societies. But, in our model, the state is predatory. By this, we mean that the goal of the state's rulers is only to maximize their own take.[14] Whereas the contractual state derives from a 'protective agency', the predatory state is more like a 'protection racket'. There is no contract with the populace, only extortion using

[10] This does not apply, however, to contractual theories where each contract is individual. There, everyone could be better off if no-one agreed to the contract. See, for example, Gambetta (1993).

[11] Hume (1994) pp.189-90.

[12] But, see Nozick's (1974, ch.1) defence of explanations based on the fiction of consent in a state of nature.

[13] They note: "[a] contract is a mutual agreement between parties involved in governing a transaction — usually in the form of a payment for a specified consideration". North's (1981) model of the state contains predatory elements, but is still contractual at heart: "the state trades a group of services, which we shall call protection and justice, for revenue" (p.23).

[14] Both Olson (1993, p.569) and Barzel (1992, p.15) dislike the term 'predatory', arguing that it either suggests opportunism or "is superfluous in an already maximizing framework". We use the term to refer only to the aims of the state (one could imagine less cynical objectives), not the consequence of those aims.

the threat of violence. Nevertheless, as we shall see, the predatory state can superficially resemble a contractual state. This resemblance, however is misleading. The two models lead to fundamentally different conclusions about the merits of the state.

The idea of a predatory state is not new. Tilly (1985, p.169), for example, warns against the standard contractual portrait of the state: "[i]f protection rackets represent organized crime at its smoothest, then war making and state making — quintessential protection rackets with the advantage of legitimacy — qualify as our largest example of organized crime". Lane (1958), Levi (1988), Kiser & Barzel (1991), Barzel (1992), and Tilly (1990) each show that informal predatory accounts of the state can be usefully applied to problems in European history.

At first glance, it is perhaps not surprising that if we model the state as predatory, it can be a bad thing. As far as we know, however, all existing models of predatory states come to the opposite conclusion. Olson (1993) and Mcguire & Olson (1996), for example, argue that the state will vastly increase both output and popular welfare. The main reason, Olson argues, is that rulers of the state will find it in their interest to provide the public goods we associate with good government. "The gigantic increase in output that normally arises from the provision of public goods gives the stationary bandit [or king] a far larger take than he could obtain without providing government. Thus government ... normally arises, not because of social contracts or voluntary transactions of any kind, but rather because of rational self-interest among those who can organize the greatest capacity for violence."[15] We agree that a predatory king, seeking to increase his revenue, will sometimes provide protection and other public goods. We do not agree, however that the populace will therefore be better off under the state than under anarchy. Indeed, we show that, even given the existence of the state, the king's provision of public goods can actually reduce popular welfare.

Our approach is closer to Usher's than it is to Olson's. Indeed, the model of anarchy we use as a benchmark is similar to that used by Usher (1989, 1992). When it comes to the state, however, Usher constructs a model that is richer (and hence more complicated) than ours. This allows him to consider several important issues from which we abstract, such as demographic and dynastic cycles (1989), rebellions and coups (1992). Overall, Usher is relatively optimistic about the effect of the state on output and popular welfare. But this optimism is more by way of a "working assumption" than a conclusion of his model; it is not his main concern.[16] In contrast, our framework allows us to solve for equilibrium output

[15] Olson (1993) p. 568.

[16] See Usher (1989) p.1040-1 and (1992) p.119-20. Usher (1992) solves for the welfare effect of the threat of rebellion within a state, but not for the welfare effect of the state itself as compared to anarchy.

and welfare levels, and directly compare them under anarchy, banditry and the state. In a recent paper, Konrad & Skaperdas (1997) also contrast anarchy with the state. They are less optimistic than Olson and Usher, but still more optimistic than us: in particular, in their model, popular welfare can never be lower under the state than under anarchy. Unlike us, they also consider collective self defence, and competition between rulers. We consider a different set of complications, such as the effects of public goods and of organized crime.

Our approach takes the power of the state as given, and proceeds from there. Thus we do not examine the mechanisms underlying this power, nor distinguish between power that comes from a capacity for violence and power that comes from reputation or awe.[17] There is, however, an important related literature in which investments by states or individuals in aggressive and defensive capabilities are endogenous and determine equilibrium allocations of power. Grossman (1991, 1994), Grossman & Kim (1995, 1996), Hirshleifer (1988, 1991, 1995), and Skaperdas (1992) show that, in this case, outcomes depend on the technology of conflict. For example, Hirshleifer (1988, 1995) and Skaperdas (1992), among other things, study the conditions under which "peaceful" or "stable" anarchy can be sustained, while Grossman & Kim (1995) consider the effect of the conflict technology on welfare and the security of property. A similar framework has been used to model, for example: international conflict (Garfinkel, 1990), insurrections (Grossman, 1991), land reform (Grossman, 1994), trading without secure property (Skaperdas & Syropoulos, 1996, 1997), and the formation of gangs (Skaperdas & Syropoulos, 1995). Historical applications of this approach include Dudley (1991) and Greif (1994).

Section 2 sets up the model of anarchy and compares this with organized banditry. Section 3 introduces the predatory state, and considers both its welfare consequences and when such a state is likely to emerge. We pay special attention to the provision of public goods. Section 4 considers two types of interaction between rulers of the state and (other) bandits: collusion and competition. These extensions may be relevant to the modern state in Southern Italy, the former Soviet Union, and parts of Africa and Latin America. Section 5 builds a dynamic version of the model in which yesterday's taxes influence behavior today via their effect on expectations of today's take.

We eschew formal propositions in this paper, but instead summarize some of the results, especially those concerning output and popular welfare, as informal observations. Intuition for most results can be seen graphically, and all formal proofs are relegated to an appendix.

[17] Power often derives simply from a coordination of expectations amongst the populace: if everyone simultaneously defies Stalin, then Stalin is no longer powerful. This was Hume's view of the power of the state: "all ... might gain with [a ruler's] fall, but their ignorance of each other's intention keeps them in awe, and is the sole cause of his security" (1994, p.190). See also Zambrano (1996).

2 Benchmarks: Anarchy and Organized Crime.

Our first benchmark against which to compare the state is a society without any form of political organization or authority. We then consider the effect of organized banditry.

2.1 Anarchy

We use a model of anarchy similar to Usher's (1989, 1992). The model has the potential to be quite rich in itself but, since our main concern here is comparison with more organized societies, we assume away much complexity. Usher supplies more detail.

Consider an economy consisting of a continuum of identical agents, each of whom can choose whether to be a 'peasant' or a 'bandit'. Peasants are producers while bandits live by 'stealing' produce (though the term 'stealing' here is rather loose since there are no formal property rights to violate). The names peasant and bandit are primarily metaphorical, but in the context of technologically primitive societies they possibly describe the main productive and predatory activities reasonably accurately. Individual well-being in each profession depends on the ratio of bandits to peasants. In addition, well-being might also depend on luck: whether the peasant happens to run into a bandit, the outcome of any fight that might ensue, and so on. To keep things simple, however, assume that welfare is deterministic. For much of what follows, this is equivalent to saying we are only concerned with expected welfare.

Let β denote the proportion of the population who choose to be bandits. By normalizing the population size to 1, we can also let β be the number of bandits. Let $R(\beta)$ denote the total product of this society when there are β bandits. That is, $R(\beta)$ is the amount produced by peasants net of any destruction resulting from conflict. Part of $R(\beta)$ is kept and consumed by peasants, and part is taken and consumed by bandits. Let $W_p(\beta)$ be the quantity consumed by each peasant and let $W_b(\beta)$ be the quantity consumed by each bandit. In later sections, peasants and bandits will be subject to 'taxation' by bandit chiefs or by the state. Anticipating these transfers, we refer to W_p and W_b as gross welfare functions. For simplicity, assume there is no storage or investment.[18] Society's resource constraint is then

$$\beta W_b(\beta) + (1-\beta)W_p(\beta) \equiv R(\beta), \tag{1}$$

where the right side shows total product and the left side divides this into an amount accruing to bandits and an amount accruing to peasants. Given this resource identity, an anarchic

[18] Including investment would allow us to address richer dynamic incentive issues but at the cost of adding complexity to the basic model. For example, it would introduce switching costs between the two occupations. The learning model of section 5 allows us to consider conceptually similar dynamic incentive effects of taxes on production without introducing such complexities.

economy can be described by fixing any two of the three functions W_b, W_p, and R. Underlying these functions are the technologies of production, of theft and of defence, available in this economy.

Most of the analysis in this and later sections will be illustrated graphically. The following three assumptions make it easy to draw such pictures. As with all numbered assumptions in this section, they will be maintained throughout.

Assumption A 1 *The gross welfare functions W_b and W_p (and hence also the total product function R) are thrice continuously differentiable.*

Assumption A 2 *When there are no peasants, $R(1) = 0$. When there are no bandits, $R(0) = 1$.*

Assumption A 3 *For all β in $[0, 1)$, $W_b'(\beta) < 0$, $W_b'(\beta) < 0$ and $R'(\beta) < 0$; that is, both gross welfare functions and the total product function are strictly decreasing.*

Assumption A1 is technically convenient, but not entirely innocuous. For example, one could imagine a defensive technology that is wasteful of resources but very effective against theft. Peasants might only find this technology worth adopting above a certain level of banditry. In this case, both bandit gross welfare, W_b, and total product, R, might jump down at the critical proportion of bandits. Among other things, our assumption rules out such discontinuities. The first statement in A2 says when there are no producers, nothing is produced. The second statement is just a normalization.

Assumption A3 is also fairly natural. Total product decreases in the number of bandits since there are fewer producers and more produce is likely to be destroyed. Moreover, as banditry increases, peasants might switch resources from production to protection. They might do this directly, say, by building walls, or indirectly, by farming lower yield products that are easier to move or by cultivating in less fertile areas that are easier to defend. Iron-age settlements in Europe, for example, appear to have sacrificed access to water for the protection of high ground. Similarly, in pre-colonial East Africa, the Kamba and Kikuyu farmed hill slopes and forests, rather than the more fertile steppes, to reduce the threat of Masai raids. Peasant welfare decreases in β since more bandits means more people trying to steal your output.[19] For bandits, more bandits means fewer, poorer, and possibly better protected peasants from whom to steal. The intuition here is similar to that in a predator-prey model (such as our contact technology example below): more sharks means fewer seals, and fewer seals means thinner sharks.

[19] The assumption that peasant gross welfare decreases is not completely innocuous. For example, if there are sharply diminishing returns to agricultural labor and bandits are very ineffective then it is possible for average peasant welfare to increase as workers are taken off the land. Our assumption, therefore, implicitly limits the degree of land scarcity and the marginal impact of each bandit.

Loosely speaking, we say that an economy is in equilibrium if no peasant wishes to become a bandit and no bandit wishes to become a peasant. More formally, we say that the proportion of bandits β^*_A is an anarchic equilibrium if

$$W_p(\beta^*_A) = W_b(\beta^*_A) \tag{2}$$

(or if $\beta^*_A = 0$ and $W_p(0) > W_b(0)$; or if $\beta^*_A = 1$ and $W_p(1) < W_b(1)$). The above assumptions are enough to ensure that such an equilibrium exists. Figure 1(a) (which is roughly analogous to Usher's (1989) figure 2(c)) shows a simple example of an anarchic equilibrium. This picture is going to be the base for much of what follows.

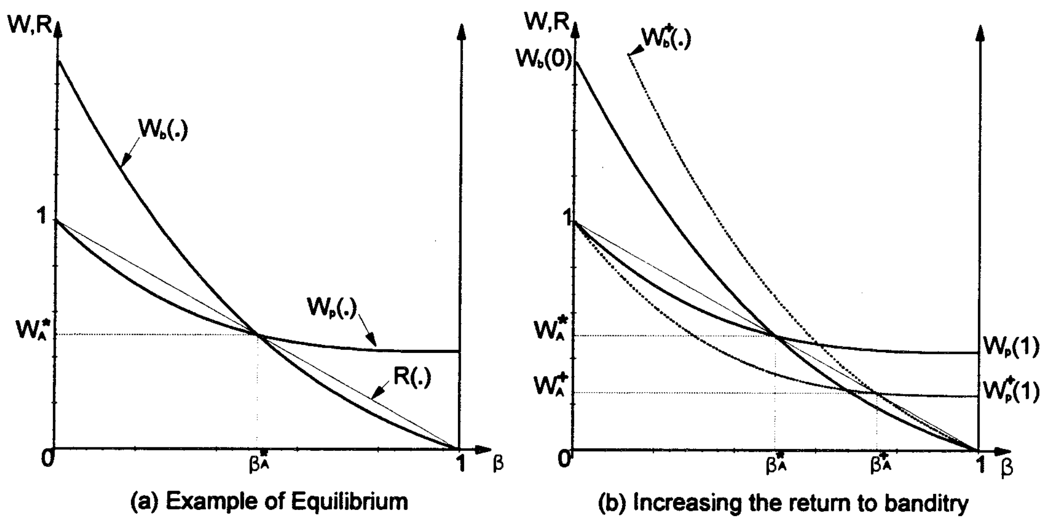

Figure 1: Anarchy

Contrary to Hobbes, life in this anarchic economy is not necessarily "nasty, brutish and short". Rather, the welfare level under anarchy depends on the technologies of production, theft and defence underlying the functions R, W_b, and W_p. In figure 1(a), the anarchy equilibrium welfare level, w^*_A, is $\frac{1}{2}$, where given our normalization, the best possible average popular welfare level is 1 and the worst is 0. To get some intuition, consider a technological change that raises the relative return to banditry while leaving the total product function, R, unaffected. Figure 1(b) illustrates the effect.[20] The equilibrium number of bandits is increased and, hence, the equilibrium welfare level of both peasants and bandits decreased. Conversely, all other things being equal, if the relative return to banditry is low then life

[20] Strictly speaking, the following comments apply to an interior unique equilibrium.

in the anarchic economy can be nice, gentle and long. Subsequent sections will compare anarchic equilibria like Figure 1(a) with those under other institutional settings.

For future reference, let V be the difference in the returns to the two professions; that is,

$$V(\beta) := W_b(\beta) - W_p(\beta).$$

With slight abuse of terminology, we will sometimes refer to V as the relative return to banditry.

The remainder of this sub-section is devoted to making additional assumptions to rule out base anarchic economies that do not look a lot like Figure 1(a), and to simplify the formal analysis. We also provide some examples using explicit functions. A less interested or more trusting reader may wish to skip.

If banditry is very ineffective — perhaps because the terrain makes it very easy to defend crops — then the only equilibrium will have no bandits. At the other extreme, if banditry is too easy, then the only equilibrium will have no producers. The next assumption rules out these extreme cases.

Assumption A 4 *When there are no bandits, the relative return to banditry is positive (and finite); when there are no peasants it is negative (and finite):* $\infty > V(0) > 0 > V(1) > -\infty$.

Loosely speaking the first statement in A4 says that if everyone else is a peasant, you would do better as a bandit. With lots of potential targets and no competition, it would be 'easy pickings'. The second statement says that if everyone else is a bandit, you would do better as a peasant. With no-one to steal from, bandits would starve, whereas if you produce, you keep a small part of your crop.

There could also be multiple equilibria. If so, by assumption A3, they are Pareto ranked: the more bandits there are, the worse it is for everyone. Multiplicity of equilibria might be of some interest in itself. For example, there could be two anarchic societies that, despite similar physical environments and technologies, differ in their degrees of banditry and their living standards. Multiple equilibria might also arise from the interaction of bandit and peasant welfares with population dynamics. For example, holding the proportion of bandits β fixed, the relative return to banditry might be higher at low population densities. Perhaps, it is easier for bandits to roam, to surprise and to hide in sparsely settled regions. If so, there might be two "Malthusian" equilibria: one with dense population, low relative return to banditry and hence low banditry; the other with sparse population, high relative returns to banditry and a large proportion of bandits. An example might be nineteenth century north America with its tame east and wild west.

Our concern in this paper, however, is to compare outcomes across exogenously given environments, technologies and, above all, institutions. Multiple equilibria are ruled out if the relative return to banditry, V, is strictly decreasing, as in Figure 1. This assumption says that the marginal effect of adding one bandit is always worse for bandits than for peasants. Suppose, for example, that the first bandits take the easiest pickings from peasants. Then, subsequent bandits will have a smaller effect on the amount taken per peasant and hence on peasant welfare. Meanwhile, since the additional take per peasant is small and the number of peasants has decreased, the take per bandit is strongly decreasing in the number of bandits. Thus, in this easy-pickings-first world, the relative return to banditry, V, will be decreasing as required.

The discussion above suggests that there is a connection between convexity of the peasant gross welfare function, W_p, and the slope of the relative return to banditry, V. We have already suggested several reasons why the peasant gross welfare function might be convex: bandits take easy pickings first; more banditry leads peasants to relocate to safer ground or to choose harder to steal crops. It is not clear whether total production is concave or convex in banditry: land scarcity, and hence diminishing returns to agricultural labor, would tend to make it concave. In fact (see the appendix), for the relative return to banditry, V, to be decreasing, it is enough if total production is less convex than gross peasant welfare. We also assume that gross peasant welfare is less convex that gross bandit welfare.[21]

Assumption A 5 *For all β in $[0,1)$, $W_b''(\beta) > W_p''(\beta) > R''(\beta)$.*

These conditions ensure that equilibria in this and subsequent sections are unique. They save us from having continually to check second order conditions. In their absence, many of the results below would be qualitatively similar but would apply only to local rather than global comparative statics.

Hereafter, when we say "all technologies", we mean all functions R, W_p and W_b satisfying assumptions A1 through A5. There are many simple explicit functional forms that satisfy all the assumptions.

Example 1 (Contact Technology) *$R(\beta) = 1 - \beta$; $W_p(\beta) = \pi^{r\beta}$; and $W_b(\beta) = \frac{1-\beta}{\beta}(1 - \pi^{r\beta})$, where π is a parameter in $(0,1)$ and r is a positive real number.*[22]

This functional form can be thought of as a "contact technology" like those used in predator-prey models.[23] We can think of r as the probability of a given peasant meeting each bandit

[21] This is implied if, for example, $W_p''' \leq R'''$.

[22] Define $W_b(0)$ as $\lim_{\beta \to 0} W_b(\beta) = -r \log \pi$.

[23] See Furlong (1987).

— so that $r\beta$ is the (expected) number of bandits met by each peasant — and of π as the probability that he will escape each encounter with his product intact. Thus, $\pi^{r\beta}$ represents (approximately) each peasant's expected final consumption. When π is low and r is high, loosely speaking, the equilibrium level of banditry, β_A^*, is high and the equilibrium popular welfare level, w_A^*, is low.

We can also use polynomial technologies such as the following.

Example 2 (Quadratic) $R(\beta) = 1-\beta$; $W_p(\beta) = (k\beta-1)^2$; *and* $W_b(\beta) = k(1-\beta)(2-\beta k)$, *where* k *is a parameter in* $(\frac{1}{2}, 1)$.

Example 3 (Cubic) $R(\beta) = 1-\beta$; $W_p(\beta) = 1 - m(\beta - \beta^2 + \frac{\beta^3}{3})$; *and* $W_b(\beta) = m(1 - 2\beta + \frac{4\beta^2}{3} - \frac{\beta^3}{3})$ *where* m *is a parameter in* $(1,3)$.

For these technologies, the anarchy level of banditry is increasing (and welfare decreasing) in k or m.

All the figures in the paper are computed examples using one of the explicit technologies above. Figure 1(a), for example, uses the cubic technology with $m = \frac{12}{7}$ so that $\beta_A^* = \frac{1}{2}$. Unless explicitly stated otherwise, however, the results do not depend on these functional forms or on the pictures.

2.2 Organized Banditry

We now compare anarchy with the consequences of organized banditry. It is almost a 'folk theorem' in this area that organization reduces the level of crime.[24] Our model confirms this result, and provides some intuition.

The simplest version of organized crime is monopoly banditry. Consider the basic economy of the previous section, but now suppose that a bandit chief can make the life of other bandits uncomfortable if they do not join his band. For the purpose of this paper, we are not concerned where the power of the bandit chief comes from, and, for simplicity, we assume that no resources are used to maintain this power. We do not assume, however, that the bandit chief's power is unlimited.

Organizing bandits might have two effects. The first is that, at each level of banditry β, gangs might be better at theft than are individual bandits. This would shift up the relative return to banditry, as in Figure 1(b), increasing the equilibrium number of bandits and decreasing welfare. To abstract from this effect, suppose that there are no internal

[24] We do not know who first pointed this out. It may have been Schelling (1967). Buchanan's (1973) reasoning is very close to ours: "[i]f monopoly in the supply of 'goods' is socially undesirable, monopoly in the supply of 'bads' should be socially desirable, precisely because of the output restriction".

economies of scale in theft. That is, assume that (holding the overall level of banditry β fixed) the optimal gang size is small enough to be operated without need of a bandit chief.

This leaves the second effect of organizing bandits: the bandit chief may restrict the number of bandits to increase his private return. Recall that increasing banditry reduces the return to all bandits. A monopolist bandit chief partially internalizes this externality, just as a product monopolist internalizes the effect of increasing output on industry prices. The product monopolist reduces output to drive up the gap between prices and average costs. The bandit monopolist reduces banditry to drive up the gap between the gross returns per bandit and the cost of hiring a bandit.[25]

We can think of the bandit chief fixing the tribute, T_b, to be paid by bandits to join his gang, and letting the number of peasants and bandits adjust so that individuals are indifferent. Equivalently, we can think of him hiring a number of bandits, collecting the gross take from their banditry, and paying them just enough so that they prefer to work for him than to be peasants or free-lance bandits. Let $W_b(\beta) - M$ be the welfare of a free-lance bandit who does not join the bandit chief's gang. We can think of M as the expected cost of hiding from the chief's wrath or of being caught by his agents. That is, M measures the power of the chief to inflict harm. If the bandit chief were to set $T_b > M$, he would collect no tribute. Conversely, if he sets $T_b < M$ all would-be bandits will pay the tribute to join his gang. Thus, provided $M > 0$, in equilibrium there will be no bandits outside the monopoly gang.

The outcome of monopoly banditry is best seen in a picture. Figure 2(a) shows the case where the constraint on the chief's power over other bandits does not bind. Figure 2(b) shows the case where it does. Both are computed for the same technology used in figure 1(a), though the results they suggest are general. Start with the case in figure 2(a); that is, the power of the bandit chief, M, is large. For every level of banditry β, the total revenue from banditry is $\beta W_b(\beta)$. In equilibrium, ordinary individuals are indifferent between being bandits or peasants, so each ordinary bandit obtains welfare level $W_p(\beta)$. The tribute level corresponding to β is then $W_b(\beta) - W_p(\beta) \equiv V(\beta)$. Thus, the bandit chief makes profits shown in the figure by a rectangle of length β and height $T_b = V(\beta)$. He chooses the level of banditry (or equivalently, the tribute level) to maximize the area of this rectangle. Let β_B^* and T_B^* be the optimum values of β and T_b respectively in the case where the power of the chief to inflict harm, M, is large. The equilibrium welfare of the populace under banditry, w_B^*, is given by $W_p(\beta_B^*)$.

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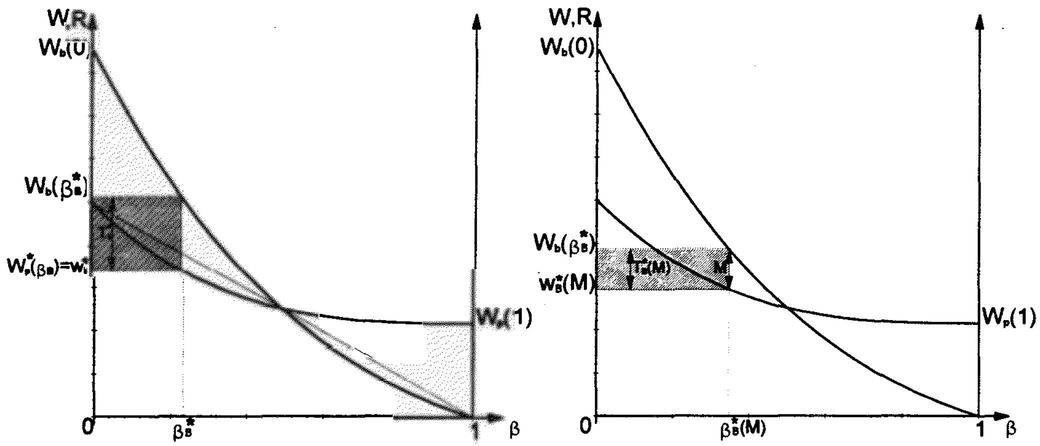
[25] **Strictly speaking, the correct analogy is to a firm who is both a monopolist in the product market and a monopsonist in the input market, but the idea is the same.**



(a) Unconstrained: M large

(b) Constrained: M small

Figure 2: Organized Banditry

The case where the constraint binds (that is, where M is small) is similar, except now the height of the equilibrium profit rectangle will be M. Let $\beta^*_B(M)$ and $T^*_B(M)$ be the optimum values in this case, denoting their dependence on M. Since, the constraint binds, $T^*_B(M) = M$ and $\beta^*_B(M) = V^{-1}(M)$ as shown in part (b) of the figure. Similar to before, the equilibrium welfare of the populace under banditry, $w^*_B(M)$, is given by $W_p(\beta^*_B(M))$.

In the appendix, we show that the first order conditions for the bandit chief's problem are sufficient. For the unconstrained case, they can be written in the following two (mutually equivalent) forms:

$$\frac{\beta^*_B V'(\beta^*_B)}{V(\beta^*_B)} = -1 \tag{3a}$$

$$W'_p(\beta^*_B) = R'(\beta^*_B). \tag{3b}$$

Equation (3a) is analogous to the usual product monopolist elasticity condition, where β corresponds to quantity and V corresponds to profit per unit (price minus average cost). Equation (3b) shows the trade-off facing the bandit chief if he were to increase the number of bandits at the margin. On the right, R' is the reduction in total production of society as banditry is increased. On the left, recall that in equilibrium all ordinary people have welfare level W_p and that we have normalized total population to one. Therefore $W'_p < 0$ is the reduction in consumption by the populace, which leaves more for the bandit chief. In figure 2(a), this condition is shown by the fact that the curves W_p and R are parallel at the optimal level of banditry, β^*_B.

The effect of monopolizing banditry on welfare is simple. Provided the bandit chief has some power ($M > 0$), monopolized crime Pareto dominates disorganized crime or anarchy. The reason is that the welfare of the populace (in this case W_p) is decreasing in banditry, and monopoly reduces the quantity of bandits. This result does not depend on strict profit maximization by the bandit chief. Again an analogy may be useful. The tribute level is like a tax on bandits. The functions W_b and W_p are like demand and supply curves respectively (albeit both are downward sloping). Just as any tax (not just a revenue maximizing tax) reduces equilibrium quantity, so any positive tribute level reduces banditry. Reducing the quantity of a 'bad' increases welfare.

We summarize all this in:

Observation 1 *Compared to anarchic equilibrium, monopolized crime leads to fewer bandits, higher output and higher popular welfare. Moreover, these effects are (weakly) larger, the greater is the power, M, of the bandit chief to harm other bandits*

It is possible to say more about organized banditry. For example, suppose that there are several bandit chiefs. For simplicity, suppose that each chief is unconstrained by his power to harm free-lance bandits but is unable to inflict any welfare losses on members of rival gangs. Suppose that each chief simultaneously chooses the number of bandits in his gang. This is a model of Cournot oligopoly banditry. By analogy, we know that the equilibrium total level of banditry and the corresponding populace welfare will lie between that under monopoly, β^*_B, and 'perfect competition', β^*_A. Similar analogies could be made for Bertrand or Stackelberg, but let us move on.

3 The Predatory State

Return to the monopolist bandit chief. Recall that we can think of him as hiring the (possibly constrained) optimal number of bandits to steal from peasants. Suppose instead that he can cut out the middlemen. That is, suppose that the bandit chief can go directly to the peasants and say "provided you pay me tribute, I will not steal from you".[26] This is known as practicing extortion. Let us call the chief who has made the transition from banditry to extortion, a 'king'; and let us call the tribute paid by the peasants to the king, 'taxes'. Then, we have here a primitive state. It may still be in the interest of the former bandit chief, now

[26] We need it to be credible first that the chief will punish a peasant who refuses to pay this tribute, and second that, if peasants pay, the chief will not take all their crops anyway. Since these issues are artifacts of our using a one-shot setting, however, we postpone a proper treatment for the dynamic model in section 5. For now, we make do with an implicit ad hoc assumption that the chief can commit to punish only those who do not pay.

king, to exert his power, if he has any, to deter other bandits. Now consider some historians, pre-armed with a contractual model, who, while searching in the archives or travelling in a time machine, come across this society. They would think they were observing a contractual state, with taxes paid by peasants to a king in return for some protection from banditry. The resemblance to a contractual state is, however, only superficial. In fact, the state is predatory: the king's only goal is to maximize his revenue. Moreover, the mis-identification matters. Despite its outward appearance, the predatory state has very different welfare consequences from a contractual state.

At first glance, one might think that 'monopoly extortion' by a king, albeit a predatory king, would be socially preferable to the 'monopoly banditry' of the previous section. After all, provided the king does not need many thug employees to threaten peasants, he need no longer keep all those bandits unproductively employed stealing for him. Indeed, for Olson (1993), it is precisely this transition from raiding bandits to taxing kings ("stationary bandits") that results in higher output and higher popular welfare. Therefore, in this section, we first compare the extortion of a predatory state with banditry and anarchy in terms of output and popular welfare. We then we consider the conditions under which extortion generates more revenue than banditry. This may give clues as to when predatory states will form. The next subsection considers the issue of state provision of public goods.

3.1 Extortion

Again, the outcome of extortion is best seen in a picture. For purposes of comparison, figure 3 is computed using the same technologies as the previous figures. For simplicity, assume that, even without any employees, the king can inflict unlimited harm on any peasant who refuses to pay tax and who remains as a peasant.[27] We can think of this as the king needing only very few thugs to destroy the house and crops of an individual recalcitrant peasant. Bandits other than the king's personal thugs, however, are harder to find and hence harder to harm. Figure 3(a) shows the case where the king has no power to harm such 'free-lance' bandits; that is, $M = 0$.

Much as before, we can think of the extortionist king fixing the tax paid by peasants, T_p, and letting the number of peasants and bandits adjust so that individuals are indifferent; or fixing the number of bandits β, and letting the tribute adjust. For every level of banditry β, the total revenue of peasantry is $(1 - \beta)W_p(\beta)$. In equilibrium, ordinary individuals are indifferent between being bandits or peasants, so each peasant obtains welfare level $W_b(\beta)$.

[27] If the chief needs an army of employees to threaten peasants, then extortion would be less efficient, strengthening our argument below.

The tax level corresponding to β is then $W_p(\beta) - W_b(\beta) \equiv -V(\beta)$. Thus, the king makes profits shown in the figure by a rectangle of length $(1-\beta)$ and height $T_p = -V(\beta)$. He chooses the level of banditry, or equivalently, the tax level, to maximize the area of this rectangle. Let $\beta_E^*(0)$ and $T_E^*(0)$ be the optimal levels of β and T_p when $M = 0$. In this case, the equilibrium welfare of the populace under extortion, $w_E^*(0)$, is given by $W_p(\beta_E^*(0))$.

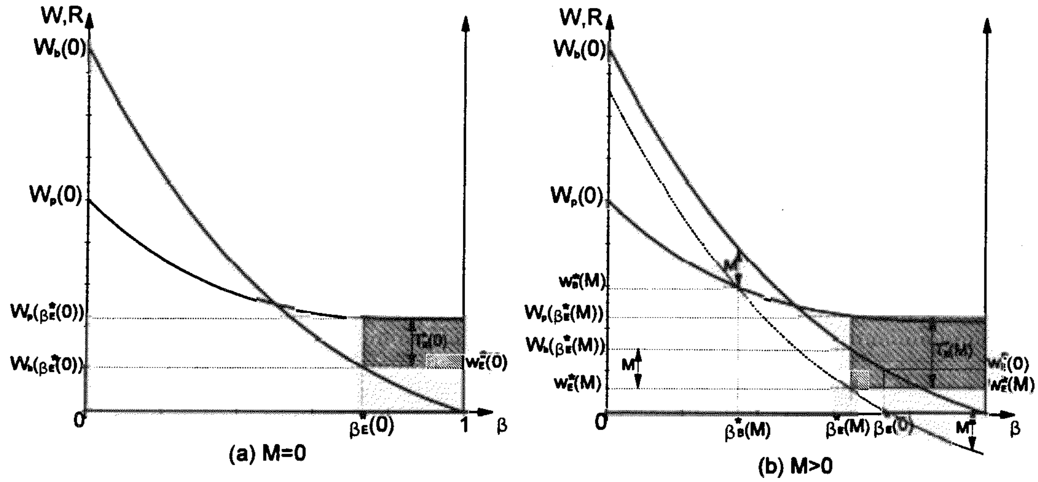


Figure 3: Extortion

Figure 3(b) shows a case where the king has some power to harm free-lance bandits (that is, $M > 0$).[28] The equilibrium condition that individuals are indifferent between being bandits or peasants now leaves each ordinary person with welfare level $W_b(\beta) - M$. This is represented in the picture by the downward shifted dotted line parallel to W_b. The height of the relevant extortionist profit rectangle is now $T_p = M - V(\beta)$. Let $\beta_E^*(M)$ and $T_E^*(M)$ be the optimum values in this case. The equilibrium welfare of the populace, $w_E^*(M)$, is given by $W_p(\beta_E^*(M)) - M$. For comparison, figure 3(b) also shows the corresponding equilibrium levels of banditry and welfare under monopolized banditry at the same M (the case in figure 2(b)), and those under extortion with $M = 0$ (the case in figure 3(a)). For still higher M, the king will be constrained by the fact that, at each level of banditry, he cannot tax more per peasant than the peasant's gross welfare at that level of banditry. In this case (not shown), tax will equal gross welfare and net welfare will equal zero.

In the appendix, we show the first order conditions for the king's problem are sufficient.

[28] Figure 3(b) appears to contradict the pictures in Usher (1989, 1992). The exercises, however, are different. Usher does not solve for the optimal tax (his model has more than 20 unknowns). Instead, he considers the two effects of the state separately: increasing the hurt to bandits (our M) and raising taxes. In our equilibrium, the tax rate is endogenous to M.

For the case of an interior equilibrium, they can be written in the following two (mutually equivalent) forms:

$$\frac{(1-\beta_E^*(M))V'(\beta_E^*(M))}{M - V(\beta_E^*(M))} = -1 \tag{4a}$$

$$W_b'(\beta_E^*(M)) + M = R'(\beta_E^*(M)) \tag{4b}$$

Where $\beta_E^*(M)$ is the level of banditry set by the king as a function of his power to harm bandits. Similar to before, condition (4a) is analogous to the product monopolist elasticity condition, where now $(1-\beta)$ corresponds to quantity and $M - V$ corresponds to profit per unit. Condition (4b) again shows the trade-off facing the king were he to increase the number of bandits at the margin. On the right side, as before, R' is the reduction in total production of society as banditry is increased. For the left side, recall that in equilibrium all ordinary people have the same welfare level $W_b - M$. Each bandit consumes W_b worth of resources and suffers a welfare loss of M imposed on him by the king. Each peasant consumes $W_b - M$ of resources. Total consumption by the populace is therefore $W_b - (1-\beta)M$. Thus, W_b' + M is the change in consumption by the populace as banditry is increased . In Figure 3(a) (where $M = 0$), condition (4b) is shown by the fact that the curves W_b and R are parallel at the optimal $\beta_E^*(M)$. At an interior equilibrium, the equilibrium popular welfare level, $w_E^*(M)$, is given by $W_b(\beta_E^*(0)) - M$.

It is already clear from figure 3 that extortion can be worse than monopoly banditry in terms of both output and popular welfare. Indeed, when the king can not harm bandits much (M is small), extortion results in lower output and lower popular welfare even than anarchy. For intuition, recall the analogy in the monopoly banditry case to a tax on bandits. This reduced the number of bandits The tribute set by the extortionist king is a tax on peasants. The result is fewer peasants, more bandits, hence less output and lower welfare.

More generally, the comparison of both output and popular welfare levels under extortion with those under monopoly banditry depends on the specific technologies of production and of banditry, and especially on the power, M, that the king or bandit chief has to harm free-lance bandits. We already saw in figure 3 that, at small M, the predatory state results in more banditry and lower welfare than monopoly banditry. More formally, a sufficient (but not necessary) condition for both popular welfare and output to be lower under extortion is that M is small enough to constrain monopoly banditry (so $V(\beta_B^*) = M$, like the case shown in Figure 2(b)).

At the other extreme, when the power to harm bandits is large, output is higher under extortion than monopoly banditry. The reason is that the bandit chief makes his living employing, or collecting tribute from, bandits, so he always wants there to be some bandits about. As M increases, therefore, the equilibrium level of banditry under monopolized banditry, β_B^*, never falls below the unconstrained level illustrated in Figure 2(a). By contrast, the extortionist king makes his living taxing peasants. The fewer bandits, the better it is for him. From the first order condition (4b), we see that, if $M \geq R'(0) - W_b'(0)$, there will be no bandits under extortion.[29]

Such a society is extremely productive and has no crime, but it does not follow that popular welfare is high. This depends on the division of output between the king and the peasants. Recall that welfare of each peasant is equal to that he could achieve were he a bandit. Loosely speaking, when there are no other bandits, this is given by $W_b(0) - M$. Thus, if M is very high, peasant welfare is driven to zero. The equilibrium will eventually be in the south-west corner of our pictures, with the entire product of society accruing to the king.

For popular welfare to be higher under extortion than under banditry, therefore, we need there to be a level of M high enough so that there are few bandits under extortion but not so high that the king gets everything. That is, we need the extortion equilibrium point in the pictures to be in the roughly triangular region (best seen in figure 2(a)) below the W_p function, above $W_p(\beta_B^*)$ and to the left of β_B^*. There are technologies of production and banditry for which the extortion equilibrium enters such a region for intermediate ranges of M.[30] For many technologies, however, including that shown in figure 3 and also including our quadratic example 2, for all parameter values k, popular welfare is higher under monopoly banditry at all levels of M.

To summarize:

Observation 2 *For all technologies, when the power, M, to harm bandits is small, both output and popular welfare are higher under either monopolized banditry or anarchy than under the extortion of the predatory state. For all technologies, when M is very large, output is higher under extortion but popular welfare is higher under banditry. And under many technologies, welfare is also higher under banditry than extortion at intermediate (hence all) levels of power over bandits.*

It is worth considering the import of this result for historians and archeologists who have found 'prosperous' ancient or medieval states. The signs of prosperity are often, on

[29] If the king needs some thugs or administrators to run his predatory state then there will be some ' hired bandits' even in this case. The result that extortion leads to high output when M is high requires that the king needs fewer than β_B^* such thugs.

[30] An example is $R(\beta) = 1 - \beta$, $W_p(\beta) = 1 - 2k\beta + k^2\beta^2 - \frac{k^2x^3}{3}$ and $W_p(\beta)$ defined using the resource identity, with $k = .61$ and M in a (small) neighborhood of .59.

the one hand, evidence of high levels of production such as terraced fields; and, on the other, the remains of palaces and splendor. Perhaps there are also records confirming a high maintenance of order. Each finding — high output, rich rulers and low crime — is consistent with a predatory state that had considerable power to harm bandits. In the model, however, these signs do not necessarily indicate a prosperous populace. Indeed, the populace may well have been better off in the more chaotic environments against which ancient states are often favorably compared.

Next, consider revenue. Although we have no such formal story here, suppose that primitive predatory states are more likely to emerge where extortion is more profitable than monopoly banditry. That is, suppose that the monopoly bandit chief is more likely to settle down and become a king, when the switch from marauding to taxing increases his take. Under what circumstances, then, are we likely to see state formation?

When there is very little power over bandits, not surprisingly, revenues are higher if directly extorted from peasants. At the other extreme, when power over bandits is very high, extortion again extracts more revenue than banditry. We have already seen that, in the limit, everyone is a peasant and their entire product goes to the predatory king. In fact, for some technologies, extortion generates more revenue than banditry at all levels of power over bandits. For other technologies, however, there is an intermediate range of M in which banditry is more lucrative. Both our contact and quadratic examples (for some parameters) illustrate this phenomenon.[31] Loosely speaking, the technologies that favor organized banditry over extortion (if only at intermediate power levels) are those in which disorganized banditry is effective relative to defence and production; that is, those technologies for which, under anarchy, banditry is high and popular welfare is low. In example 1, this corresponds to low π and high r; in example 2, high k. Intuitively, in such societies there tend to be many bandits and few peasants to tax.

In parts of early medieval Europe and parts of pre-colonial East Africa there appears to have been only minimal state formation. The model suggests two plausible reasons why this might have occurred. First, bandit leaders in these areas might have had only intermediate power over their fellow bandits, not sufficient to deter all banditry were the leader to abandon his profession and became an extortionist king. Second, these might have been economies that would have technologically favored even disorganized banditry. Defence may have been expensive, while strategies of raid and flight were easy to undertake.

[31] Recall that the quadratic technology never yields higher popular welfare under extortion than under monopoly banditry, regardless of k or M. For k close to 1 and $M = \frac{1}{2}$, however, it yields higher revenue under banditry. Thus, the technologies for which banditry can yield higher revenues are not those which banditry can generate higher popular welfares. Very loosely speaking, it is harder to find examples of the latter.

The model also warns against concluding too much if we were to find low welfare in economies with minimal states. Societies where banditry is relatively effective tend both to be poor and to be those in which organized banditry is favored over direct taxation of peasants. That is, limited state formation may be caused by, rather than the cause of, economies with high banditry and low welfare.

3.2 Public Goods

In both contractual and optimistic predatory accounts of the state, the main supposed benefit of the state comes from its provision of public goods.[32] If there are goods or services that are privately costly to produce and whose social benefit exceeds their private benefit, such goods will be under-provided, or not provided at all, under anarchy. Consider, for example, protection from or hostilities against bandits. It may not be worthwhile for an individual peasant to pursue bandits into the forest but, all other things being equal, peasants as a whole would benefit from the reduction in banditry if one peasant did so.

In the contractual model, the state provides public goods in fulfillment of its side of the supposed bargain; in this case, chasing off bandits in return for tax payments. Predatory accounts of the state deny the existence of such a deal. But, since the king is a large player, taxing peasantry as a whole, he may internalize at least part of the externalities involved in providing public goods. Thus, in this case, he will chase off bandits regardless of his lack of a contractual obligation to do so. This idea is central to Olson's (1993) analysis:

> "... a stationary bandit [or king] has an encompassing interest in the territory he controls and accordingly provides domestic order and other public goods. Thus he is not like the wolf that preys on the elk, but more like the rancher who makes sure that his cattle are protected and given water. ... No metaphor or model of even the autocratic state can therefore be correct unless it simultaneously takes account of the stationary bandit's incentive to provide public goods at the same time that he extracts the largest possible net surplus for himself".[33]

In such predatory accounts, the king's purpose in providing such goods is not to increase popular welfare but rather to increase the amount that can extorted as revenue from the populace. Nevertheless, in optimistic predatory accounts, popular welfare will be increased as an unintended consequence.

> "In fact, when an optimizing entity with coercive power has a sufficiently encompassing interest ... the invisible hand will lead it, remarkably, to treat those

[32] In the following, we will use the term public good rather loosely. For example, we will not distinguish pure public goods from club goods.

[33] Olson (1993, p.569).

subject to its power as well as it treats itself".[34]

By contrast, in our pessimistic predatory account of the state, if a ruler has the ability to provide public goods, the populace may actually be made worse off. In this section, we try to identify what kind of public goods help the populace, what kinds hurt, and why; and we briefly discuss what kinds of public goods will be provided by the predatory state.

To see how the ability to provide public goods can reduce popular welfare, return to the example of chasing and punishing bandits. Suppose that the power to make life unpleasant for bandits, M, does not come for free, but that the king must pay for it out of his tax take. Perhaps he maintains a gallows and feeds a police force who pursue bandits. Suppose now that police or punishments become cheaper so that the king increases M. On the one hand, making life more hazardous for bandits results in less banditry, increasing the welfare of all peasants and bandits. This 'bandit effect' is the sense in which pursuit and punishment are public goods. On the other hand, however, the only limit to the king's ability to raise taxes is that peasants can become bandits. The more the king can hurt bandits, the more he can tax peasants without them exercising this outside option. Thus, if the level of banditry were held fixed, this 'tax effect' of increasing M reduces the welfare of both bandits and peasants.[35]

To see the two conflicting effects formally, first assume that the cost of producing M is sufficiently convex always to ensure an internal solution to the king's problem. For now, also assume that overall production, R, is not directly affected by the production of the public good. The marginal net effect of increasing M on the popular welfare at an interior equilibrium is then given by

$$\frac{d}{dM}\left(w_E^*(M)\right) = -1 + \frac{W_b'(\beta_E^*(M))}{R''(\beta_E^*(M)) - W_b''(\beta_E^*(M))}. \tag{5}$$

The first term (-1) is the tax effect, holding the level of banditry fixed. The second term is the bandit effect: the change in welfare from the reduction in banditry caused by the change in M (and the induced change in taxes). Under our assumptions, this second term is positive,[36] so the overall marginal effect can go either way. In figure 3(b), the tax effect is shown by the vertical drop from the old equilibrium point, $(\beta_E^*(0), w_E^*(0))$, on the W_b line to

[34] Mcguire & Olson (1996, p.73-4).

[35] In Olson's model, "though the amount collected at any tax rate will vary with the level of public-good provision, the revenue maximizing tax rate for the autocrat should not" (1993 p.570). This fact yields his unambiguously optimistic conclusions about public goods, but it is not true in more general models.

[36] Within this term, the denominator reflects the change in the equilibrium level of banditry, β_E^*, as we increase M. Notice that for *local* comparative statics of interior equilibria, we do not need the later assumptions: the denominator is negative by virtue of the second order conditions.

the dotted $W_b - M$ line below. The bandit effect is the slide up the dotted $W_b - M$ line to the new equilibrium point, $(\beta_E^*(M), w_E^*(M))$. For the particular cubic technology illustrated, the tax effect dominates: increasing the king's power shifted the equilibrium south-west, lowering popular welfare. There are other technologies (for example, our quadratic technology with $k = 1/\sqrt{2}$) for which the bandit effect can dominate, at least for some ranges of M. We have already established, however, that for all technologies, in the limit as M becomes large, the negative tax effect always wins out.

The reader might object that the pursuit and punishment of bandits is a one-sided example of a public good in that it reduced bandit welfare without positive direct effects on peasant welfare or on output. Less one-sided public goods, however, can also have negative net welfare effects. Consider, for example, a public good that simply increases total output, making more available regardless of whether it is eventually taxed by the king, stolen by bandits, or kept by peasants. The king might fund an irrigation project or encourage technical innovation in production, or he might provide contract dispute adjudication or otherwise encourage trade. A simple way to model this is to multiply the output and gross welfare functions through by a constant, $\gamma > 0$. The resource constraint then becomes:

$$\gamma R(\beta) = \beta\gamma W_b(\beta) + (1-\beta)\gamma W_p(\beta).$$

Increasing γ is interpreted as the effect of the irrigation project or of increased trade.

In the absence of a state, increasing γ has no effect on the anarchy level of banditry but increases the equilibrium welfare level of all bandits and peasants. The outcome is like that shown in figure 1(a) except that the vertical axis has been re-scaled. In the presence of a predatory state, however, the net effect is more complex. Assume that no other public goods are available; in particular, assume that the ability of the king to harm bandits, M, is fixed at a positive level such that the extortion equilibrium is interior. Then, there are again two conflicting welfare effects of increasing irrigation or encouraging more trade.

Formally, the marginal net effect of increasing γ is given by

$$\frac{d}{d\gamma}(w_E^*) = W_b + \frac{-M}{\gamma^2}\frac{\gamma W_b'}{(R'' - W_b'')}, \tag{6}$$

where the arguments of all functions have been suppressed. The first term (W_b) is the tax effect. Unlike the pursuit and punishment of bandits, the irrigation project or encouragement to trade has a positive direct effect on bandit welfare, holding the level of banditry fixed. There is more for bandits to steal, and this limits the amount that the state can extort from peasants. The other term is the bandit effect. It is negative: that is, if $M > 0$, the irrigation project increases the level of banditry. The reason is that the ability of the king to harm bandits, M, is not affected by the irrigation project. Since everything else is increased, this is like a proportional reduction in M (hence the term $\frac{-M}{\gamma^2}$). But, as we already saw from the first example of a public good, decreasing M raises the level of banditry. Thus, once again, the net effect of the public good on the welfare of the populace under extortion can go either way.[37]

Although only two specific examples of public goods were considered here, the idea is quite general.[38] We can always break the net welfare effect of a public good into two parts: a tax effect holding the level of banditry fixed, and a banditry effect. Since, peasants will be taxed to the point at which they are indifferent between remaining peasants and becoming bandits, public goods whose direct effect is to hurt bandits will have negative tax effects. Since more bandits means lower welfare, public goods that result in more banditry (after allowing for any induced change in taxes), will have negative bandit effects. Often, as in the above examples, we can sign each effect of an increase in a particular public good regardless of the specific technologies underlying R, W_p and W_b. The problem is that the two effects are often in opposite directions, with their respective strengths depending on the technologies. The pursuit and punishment of bandits only increases popular welfare if the (positive) bandit effect is large. Irrigation and the encouragement of trade only decreases popular welfare if the (negative) bandit effect is large. In both cases the size of the bandit effect depends on the same curvature term $\frac{W_b'}{(R''-W_b'')}$. Loosely speaking, therefore, the kinds of technologies of production and of theft for which pursuing bandits can be good are similar to the technologies for which irrigation can be bad.

Again, we collect these results in the form of an observation:

Observation 3 *Increasing the provision of public goods by a predatory state can increase but can also decrease popular welfare. This result holds not only for those one-sided public goods such as pursuing and punishing bandits that have no direct welfare benefits. It also applies to public goods like irrigation projects or contract adjudication, which only have positive direct effects on popular welfare.*

The idea that the provision of public goods can make the populace worse off has implications for historians and others who analyze predatory organizations. Recall that if a state taxes peasants and provides public goods out of the revenues collected, it appears superficially

[37] Pictures of the effect of increasing γ tend to be rather messy, but are available from the authors on request. For an example where increasing γ decreases welfare, again consider the quadratic technology with $k = M = \frac{1}{\sqrt{2}}$, and γ between 1 and 1.5.

[38] Other examples are available from the authors, on request.

a lot like a contractual state. To some extent, Gambetta's (1993) path-breaking contractual analysis of the Sicilian mafia falls into this trap. Gambetta gives many examples to show that protection offered by the mafia is "genuine"; that is, the service is actually provided.[39] He uses this to argue that the mafia is not practicing extortion. Our model, however, draws the interpretation of this evidence into question. First, a predatory, non-contractual organization practicing extortion would also provide services if by doing so it increased revenue. More importantly, some of the 'public goods' provided by the mafia might actually reduce popular welfare. That is, ordinary Sicilians might be better off under 'pure extortion' with no services 'in return'.[40] Similarly, historians point to the benefits of having the state secure passage through the forest but they ignore the cost to the populace that their option of living as bandits in the forest is now less attractive. Outlaws in the middle ages were not only outside the law but also outside the grasp of feudal dues and taxes.

Even when the output and welfare effects are positive, not all public goods will be provided by the state . Return to the example of irrigation or encouraging trade. Assume, again, that the ability of the king to harm bandits, M, is fixed at a positive level at which the extortion equilibrium is interior. In the model with a public good represented by γ, the king's revenues are given by

$$(1-\beta_E^*(M))(M-\gamma V(\beta_E^*(M))).$$

Thus (by the envelope theorem), revenues are decreasing in γ whenever the relative return to banditry, V, is positive. This will occur at any technology and parameter M such that extortion results in fewer bandits than anarchy, $\beta_E^*(M) < \beta_A^*$. If we interpret γ as a productivity parameter, the same example also shows that the state will sometimes oppose technical progress.

Besley & Coate (1997) show that even a democratic state may fail to fix market failures in a Pareto improving manner. The case of the predatory state is, not surprisingly, more extreme. It sometimes provides public goods in such a way as to make everyone except the ruler worse off, and it sometimes fails to provide them when they could make everyone, except the ruler, better off. In short, maximizing revenue is not the same thing as maximizing output or popular welfare. To expect a predatory state to do the latter out of enlightened self interest is wishful thinking.

Some public goods, however, will increase both revenue and welfare. A simple case is a

[39] See especially, pp. 28-33 and chs. 7-10.

[40] Gambetta also allows that protection can hurt the protected, but his reasons are different. He points out that if some 'buy' more protection, there may be a negative externality as crime is diverted to the less unprotected.

public good that increases peasant welfare but has no direct effect on bandit welfare. An example might be an entertainment, a fair, fête or circus, funded from taxes, from which bandits could be easily excluded. Such a public good has no direct tax effect on bandit welfare but it reduces banditry, increasing popular welfare. It also increases revenue: since peasants benefit from the circus, more can be taxed from them before they become bandits.

One prediction, then, of the model is that primitive predatory states are more likely to provide fairs or to deter banditry than they are to provide irrigation or to encourage trade. The former types of public good always increase revenue, whereas the latter types, particularly for states of only intermediate power, can reduce it. Fêtes, fairs and public merriment fit our popular image of life in the feudal manor, while Bloch (1961) reports that internal order was one of only three public goods expected of the early feudal state.[41] The model also predicts, however, that the state will provide irrigation in cases where it is so powerful that no bandits exist and all output accrues to the king. Smith, Mill, and Marx and (much later) Wittfogel (1957) each believed that public hydraulic works were associated with the existence of despotism, especially in the ancient far east.[42]

4 Interactions between Bandits and the State

In this section we first ask what is the effect of the state making a deal with the bandits. We then consider the effect of organized crime and the state on each other.

4.1 Corruption

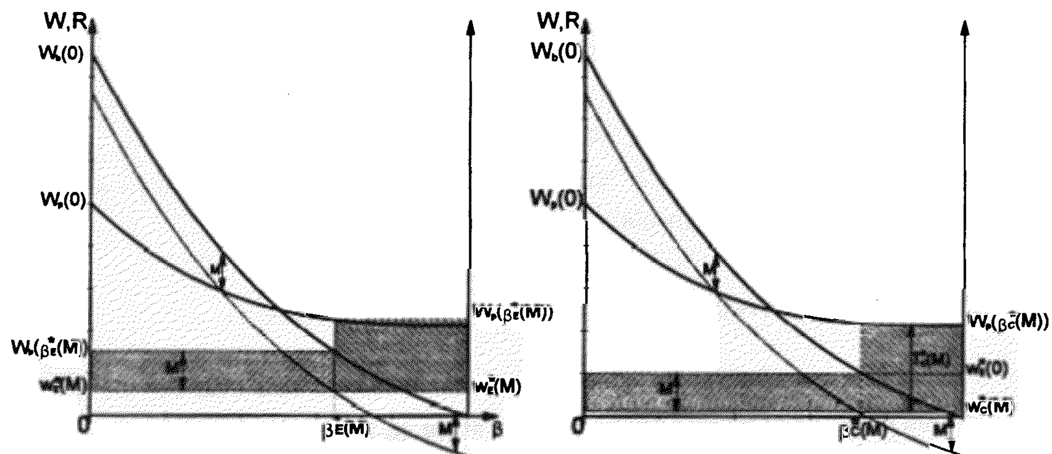
Return to the model of section 3.1 where the king had some fixed ability, M, to hurt bandits, and extorted taxes from peasants. Suppose that, instead of inflicting harm on the bandits, the king goes to them and says "provided you pay me a bribe, I will let you be". An historian who (wrongly) believed the state to be contractual might interpret such side payments from bandits as corruption. We will adopt this term even though it is perhaps redundant to call a predatory state corrupt. In this section, we ask how such corruption affects revenue, output and welfare.

In extortion equilibria such as that shown in figure 3(b), the total harm done to bandits, βM, is a pure loss to society. Figure 4(a) shows the effect of transforming this loss into a transfer, holding output and popular welfare fixed. As before, the right shaded rectangle

[41] Bloch (1961) p. 408. The others were protecting the faith and defending from foreign foes. Elsewhere (p. 61) Bloch attributes the decline in safe roads to the collapse of the more powerful Carolingian state.

[42] For a (very critical) discussion of Smith, Mill and Marx's views on the 'Asiatic Mode of Production', see Anderson (1974b) pp.462-549.

is the king's tax revenue from peasants. The left shaded rectangle was previously a dead weight loss and is now additional revenue in side-payments from bandits. If this was the end of the story then the state that appears corrupt would (weakly) Pareto dominate that which did not. Unfortunately, figure 4(a) is not an equilibrium. Without side payments, the king's tax base consisted only of peasants. A disincentive for the king to raise taxes was that it would erode this base. With side-payments, however, it is as if bandits are also in the tax base; albeit at a fixed 'tax rate', M. So, the cost to the king of peasants' becoming bandits is reduced. Thus the new equilibrium, shown in figure 4(b) has higher taxes, more bandits (hence lower output), and lower welfare.


(a) Opportunities for deals

(b) Side Payments and Taxes

Figure 4: Corruption

In fact, if the equilibria both before and after side-payments are interior, we can be much more precise. In the appendix, we show that the first-order condition for an interior corruption equilibrium can be written as

$$W'(\beta_C^*(M)) = R'(\beta_C^*(M)), \tag{7}$$

where $\beta_C^*(M)$ is the level of banditry that maximizes revenue under corruption, given M. Comparing expression (7) with the earlier extortion first order condition, (4b), we see that the level of banditry with corruption when the ability to harm bandits is M is equal to the level of banditry without corruption that would occur were $M = 0$. That is, $\beta_C^*(M) = \beta_E^*(0)$. This is illustrated by comparing figures 3(a) and 4(b). Recall the intuition for expression (4b): as the king increased the number of bandits at the margin, the amount of resources consumed by the populace changed by $W_b' + M$. The extra M was to 'compensate' the extra bandit for the harm done to him. Now, however, although bandits steal M more than they consume, they finally consume the same amount of resources as peasants. The first order condition is the same, therefore, as if the compensatory consumption term under extortion were zero.

Side deals between the rulers of states and bandits tend to attract the wrath of the press and of folklore. In a contractual model of the state, each such deal constitutes a breach of the contract. The model above suggests that popular hostility toward such deals makes sense even in the absence of a contract. The level of banditry under corruption (at an interior equilibrium) is equal to the highest that can occur under extortion, higher than under anarchy or monopolized banditry. That is, corruption can result in as low output as we have seen so far in this paper. Similarly, if it is not zero, popular welfare under corruption, w_C^*, is only $W_b(\beta_E^*(0)) - M$.

Corruption always increases the king's revenue. This is not surprising since he is now playing both sides of the market. Given this, we might expect predatory states always to make side deals with bandits. Perhaps one reason we do not see more such deals is that actions by the state against bandits (such as night raids into the forest) tend to hurt all bandits so that deals with individual bandits are difficult. Alternatively, perhaps there were more side deals between kings and (at least, larger) individual bandits than it first appears. One could develop a model of feudalism here, but we prefer to move on. To summarize:

Observation 4 *When the king has some potential to harm bandits, 'corrupt' side-deals between the king and bandits increase the king's revenue. Popular welfare is lower, sometimes decreased to the lowest feasible level. When it is not, the level of banditry is the same a would occur (without side-deals) were the king to have no power to harm bandits.*

4.2 The State and Organized Crime

It is often asserted, particularly in the context of present-day Russia, that the existence of organized crime is bad for the state. In this section, we consider the effect of organized banditry and the predatory state on each other's revenues as well as on output and popular welfare.

Return again to the king extorting tax from peasants. To keep things simple, assume that the king has no ability to harm bandits ($M = 0$). We saw in figure 3(a) that the resulting equilibrium has many bandits. Suppose that someone organizes these bandits. Much as in section 2.2, assume that there is a bandit chief who can make life uncomfortable for any bandit who remains outside his gang. Again, to keep things simple, suppose that this chief has unlimited power to harm other bandits but does not extort revenue directly from peasants. We saw in figure 2(a) that, in the absence of the predatory state, this chief would hire relatively rather few bandits. We now consider what happens if there is both a bandit chief getting tribute from bandits, and a peasant king getting tax from peasants.

If the chief and the king were to cooperate, they could ensure that there were no bandits and that all output accrued to them. But, let us suppose that they do not cooperate. Specifically, suppose that the king sets tax level T_p on peasants and that the chief, simultaneously, sets tribute level T_b on bandits, each aiming to maximize his individual revenue. As usual, we assume that the level of banditry resulting from any tax and tribute pair is such that the populace is indifferent between the two professions.

Formally, analogously to expression 2, for each pair of tax and tribute levels, T_p and T_b, we assume that the level of banditry, $\beta(T_p, T_b)$ is given by:

$$W_p(\beta(T_p, T_b)) - T_p = W_b(\beta(T_p, T_b)) - T_b \tag{8}$$

or $\beta(T_p, T_b) = 0$ if $W_p(0) - T_p > W_b(0) - T_b$; and $\beta(T_p, T_b) = 1$ if $W_p(1) - T_p < W_b(1) - T_b$.[43] For each T_p and T_b, then, the revenue of the bandit chief is given by

$$\beta(T_p, T_b)(\min\{T_b, W_b(\beta(T_p, T_b))\})$$

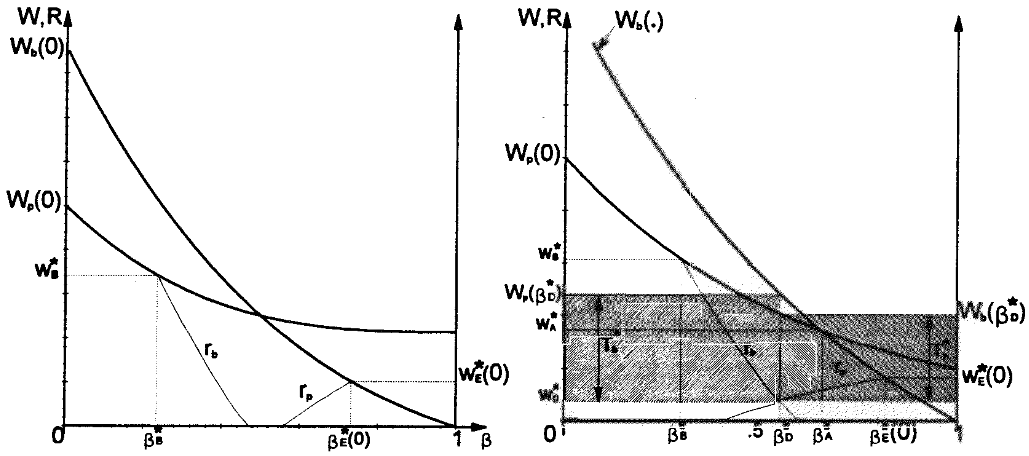
where the minimum reflect the fact that the chief cannot take more from each bandit than the bandit manages to steal. Similarly, the revenue of the peasant king is given by

$$(1 - \beta(T_p, T_b))(\min\{T_p, W_p(\beta(T_p, T_b))\})$$

Figures 5(a) and 5(b) illustrate possible outcomes. These pictures are constructed as follows. First, we compute best-response functions for both the peasant king and the bandit chief and then, loosely speaking, invert them so we can represent them in our familiar banditry-welfare diagram. In each figure, the curve labelled r_b shows the banditry and welfare levels that would result from the bandit chief setting his tribute level, T_b, taking as given the tax level, T_p, set by the peasant king. If T_p is fixed at 0, the bandit chief's problem is similar to that discussed in section 2.2 where the chief was not constrained by M. So the curve r_b goes through the point (β^*_B, w^*_B). In general, for any point on the locus r_b, the corresponding tribute level T_b set by the bandit chief is the vertical distance between W_b to r_b. The tax level, T_p, that induced this response is the vertical distance between W_p and r_b.

[43] Our earlier assumptions ensure that $\beta(T_pT_b)$ is unique. The net welfares in this expression could be negative. One could argue that, in such cases, it is more natural to assume that the level of banditry resulting from T_p and T_b is given by: $\max\{0, W_b^{-1}(T_b)\}$. Adjusting subsequent expressions in the model appropriately, however, all the results below go through.

As T_p increases, the bandit chief's best response (if interior) results in increased banditry and lower welfare, so the curve r_b slopes to the south-east. In the appendix, we show that this reaction is general across technologies.



(a) No Interior Equilibrium

(b) Interior Equilibrium

Figure 5: State Bandit Duopoly

Similarly, the curve labelled r_p shows the banditry and welfare levels that would result from the peasant king setting his tax level, T_p, taking as given the tribute level, T_b, set by the bandit chief. If T_b is fixed at zero, the king's problem is similar to that discussed in section 3.1 with $M = 0$. So, the curve r_p goes through the point $(\beta_E^*(0), w_E^*(0))$. In both figures 5(a) and 5(b), as T_b increases, the peasant king's best response (if interior) results in decreased banditry but lower welfare, so the curve r_p slopes to the south-west. Unlike the r_b case, however, this reaction is not general across technologies. In the appendix, we show that banditry always decreases but that welfare can go either way. In fact, the argument contains the same two effects as appeared in expression (5) except that the tribute taken by the chief from bandits, T_b, replaces the harm, M, inflicted on bandits by the king. Both T_b and M are essentially waste from the point of view of the king.

Let us abuse terminology and refer to the two lines, r_b and r_p as reaction curves.[44] If the curves cross, where they do so is an interior equilibrium. Let β_D^* be a duopoly equilibrium level of banditry and let w_D^* be the corresponding equilibrium popular welfare level. Figure 5(a) shows the same specific parameterization of a cubic technology that underlied figures 1 through 4. For this technology, there is no interior crossing point thus there is no interior

[44] Formally, reaction curves live in strategy space whereas these curves live in bandit-welfare space.

equilibrium. There is, however, an equilibrium on the boundary with popular welfare, w_D^*, equal to 0.[45] Figure 5(b) is computed using a particular parameterization of the contact technology of example 1. In this case, there is an interior equilibrium, and we show the corresponding welfare, banditry, tax and tribute levels. The left and right shaded rectangles shows the bandit chief's and the king's equilibrium revenues respectively.

The banditry and popular welfare levels shown in figure 5 are typical of those resulting from the competition between king and bandit chief. We show in the appendix that, if there is an interior equilibrium then it is the unique interior equilibrium, and it must satisfy the following (surprisingly simple) equation

$$\frac{T_p^*}{(1-\beta_D^*)} = \frac{T_b^*}{\beta_D^*} \tag{9}$$

where T_p^* and T_b^* are the equilibrium tax and tribute respectively. The level of banditry, β_D^*, in such an equilibrium is always greater than that under monopolized banditry, β_B^*, and less than that under the extortionary state, $\beta_E^*(0)$.[46] More precisely, if it exists, the interior duopoly equilibrium level of banditry always lies between the anarchy level, β_A^*, and one half (hence output lies between its anarchy level and $R(\frac{1}{2})$).[47] Thus, for example, given an environment in which the level of banditry under anarchy would be high, the level of banditry when the state and organized crime compete is also high, albeit not as high ($\beta_A^* > \beta_D^* > \frac{1}{2}$). Figure 5(b) shows an example of this case.

When the state competes with organized crime, the resulting level of popular welfare is low. Even if the equilibrium is interior, the level of popular welfare, w_D^*, is always less than that under monopoly banditry, w_B^*. If the anarchy level of banditry is less than $\frac{1}{2}$, then $w_D^* < w_A^*$. And even if $\beta_A^* > \frac{1}{2}$, then $w_D^* < W_p(\frac{1}{2})$ ($< W_b(\frac{1}{2})$). However, since there can be an interior equilibrium (that is, popular welfare is not always zero), this is better than if the bandit chief and the peasant king combined their powers and colluded.

The presence of the state actually increases the revenue of the bandit chief and the presence of the bandit chief increases the revenue of the state. The reason is that the bandit chief, by extracting tribute, makes it less desirable to become a bandit so allowing the peasant king to charge higher taxes without inducing as many to abandon peasantry. Similarly, the peasant king's tax worsens the outside option for bandits, allowing higher tribute levels. The sum of the two revenues, however, never reach maximum total output (that is, by our

[45] In general, it can be shown that a sufficient (but not necessary) condition for the existence of pure strategy equilibria is for $\beta W_b(\beta)$ to be quasi-concave. This is satisfied by all our examples.

[46] For a boundary equilibrium, it can still be shown that $0 < \beta_D^* < \beta_E^*$ and $\beta_D^* < \max\{1/2, \beta_A^*\}$.

[47] We thank David Pearce for suggesting this result.

normalization, one). The reason is that the bandit chief only collects revenue from bandits, so he always sets his tribute level T_b low enough to ensure that there are some bandits in his tax base. If the level of banditry under anarchy is high (greater than $\frac{1}{2}$), the revenues of the bandit chief exceed those of the king when they compete.

To summarize:

Observation 5 *The state and organized crime benefit from each others presence in that they get higher revenues even if they compete in setting taxes and tributes. In this setting, popular welfare levels are low, often lower than under anarchy or under the predatory state in the absence of organized crime. Often popular welfare is driven to the lowest feasible level, even though banditry has been reduced by organized crime. When welfare is not at its lowest feasible level, the proportion of bandits in the population always lies between its anarchy level and one half.*

The result that organized crime can be good for the state is, at first glance, somewhat surprising. We are used to thinking of the mafia as undermining the state. The result comes from our assumption that the bandit chief (or mafia) does not compete directly with the state for extortion payments from peasants. In contrast, Grossman (1995a) allows the mafia and the state to compete directly both in tax and in public good provision. In his model, the mafia reduces state revenue. It would be interesting to combine elements of Grossman's model with the extra effect we identify here; that is, the mafia, by 'taxing' bandits, increases the tax base of the state. This effect has attracted little attention though its converse is well-known. That is, if the state either taxes, or places obstacles in the way of, 'legal' trade, it benefits crime lords whose income comes from 'illegal' activities. The best known examples are prohibition of alcohol, narcotics and gambling.

The model's predictions about output and welfare are relevant for the real world. The result that popular welfare is relatively low where there is both a state and a mafia (and very low if they collude) is a familiar story, for example, in southern Italy. The result that wherever banditry is very easy compared to productive activity, more than half the population will still be bandits if there is both organized banditry and a predatory state does not bode well for modern Russia. To make things worse the revenues of organized crime will exceed those of the state.

We could also analyze an analogous model in which the state sets T_p before the bandit chief sets T_b. In this case, one can show that popular welfare is zero and the level of banditry is low (but not zero). Other permutations of the model are left to the reader.

5 Dynamics

In this section, we consider a dynamic version of our basic model from section 3.1. Earlier, we ignored credibility issues such as the king's inability to commit not to seize the peasant's entire product regardless of his promise beforehand. This problem is, at least in part, an artifact of our having used a static model. For example, Barzel (1992) argues that, in a dynamic setting, if a ruler were to seize a peasant's product then others would learn to expect such confiscations and would be reluctant to produce in the future: "[a]s long as the ruler's immediate gains from confiscation fall short of his future losses, subjects do not have to fear confiscation".[48] Thus, a long-lived and patient king can, at least to some degree, credibly promise to limit taxation. Here, we formalize Barzel's intuition. To do so, we use a learning model in which the populace forms an expectation of how much the king will take based on past experience. This seems close to what Barzel and others have in mind.

Another reason to consider a model with a long time horizon is that this offers a fairer comparison with McGuire & Olson (1996) or Gambetta (1993). These writer's relatively optimistic claims for autocracy are not intended to apply to short-term rulers. We show, however, that the pessimistic conclusions of our model can extend to a long-term setting. That is, if the only constraint on the king is his fear of inducing high future tax expectations, the predatory state can still yield low output and low popular welfare.

To show this, we use an infinite horizon model. As in section 3.1, the king taxes peasants. For simplicity only, assume that the king has no power to harm bandits. It is straightforward to redo the analysis for $M > 0$. The populace uses past taxes to form an expectation of current taxes. Formally, we use a continuous-time non-linear 'adaptive expectations' learning model.[49] Let $T(t)$ be the level of tax and let $T^e(t)$ be the expected tax level at time t. At each moment, the rate of change in the expected tax level depends on the difference between actual taxes and expected taxes:

$$\dot{T}^e(t) = f(T(t) - T^e(t)). \tag{10}$$

Assume that correct expectations are not changed, that expectations always adjust in the right direction, and that larger underestimation leads to larger adjustment: that is, $f(0) = 0$ and $f' > 0$. Also assume that the adaptive function is convex, $f'' > 0$. Loosely speaking,

[48] Barzel (1992) p.11.

[49] Allowing the tax rate to vary continuously is a considerable simplification. In adaptive expectations models, stability requires past underestimates of tax to result in large upward adjustments. In the discrete-time model, tax expectations may need to 'overshoot' the feasible set. This can be dealt with by using a dummy state variable but this adds complexity. This problem does not arise in a continous time adjustment setting.

this means that the populace adjust their expectations more if they underestimated tax than if they overestimated. There is some evidence that the formation of inflation expectations has a similar asymmetry, but our main reason for this assumption is technical: without it there may be no way of converging to a steady state.

At each moment, the proportion of bandits depends on the expected tax level. Specifically, each individual expects to be equally well off as a bandit or as a peasant:

$$W_p(\beta(T^e(t))) - T^e(t) = W_b(\beta(T^e(t))). \tag{11}$$

The king understands this and the way the populace form expectations. He chooses taxes to maximize present discounted tax revenues:

$$\int_{t=0}^{\infty}(1-\beta(T^e(t)))T(t)e^{-\rho t}dt,$$

subject to (11) and (10) , where ρ is the king's discount rate. This is an optimal control problem where the actual tax level, T, is the control variable and either the expected tax level, T^e, or (equivalently) the level of banditry, β, is the state variable.

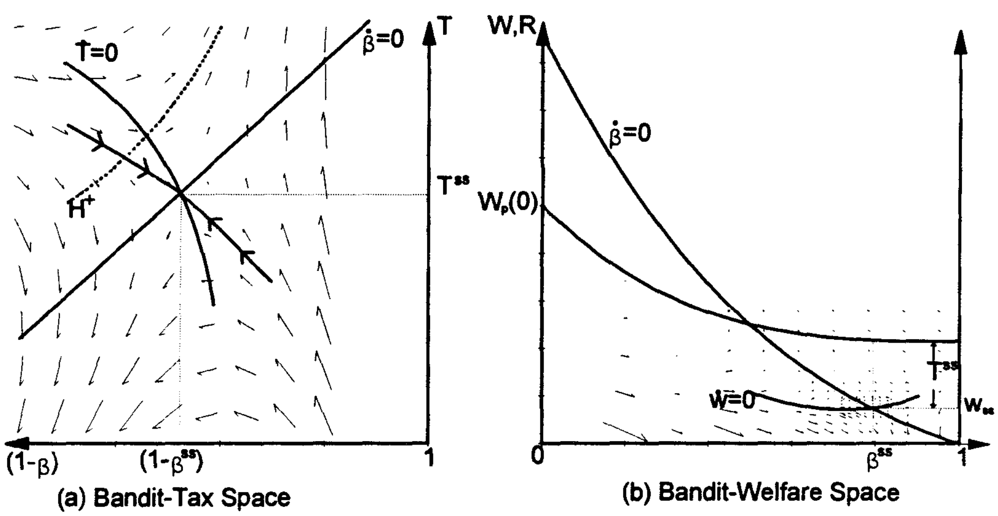


Figure 6: Dynamics

We can illustrate using phase diagrams. Figure 6(a) shows the vector field computed for a quadratic technology with an exponential adaptive function and a 10% discount rate. The negative horizontal axis shows the number of peasants $(1-\beta)$, while the vertical axis shows the actual tax level T. We have drawn in the saddle path near the steady state. Just as we transposed reaction curves in section 4.2, so figure 6(b) transposes the phase diagram into our familiar bandit-welfare diagram. The vector field shown again assumes an exponential adaptive function and a 10% discount rate, but, to ease comparison, we used the same cubic technology as figure 3. For this case, near the steady state, the saddle path lies very close to the $\dot{w} = 0$ locus so it is not shown separately. From expression (11), when taxes are anticipated correctly, popular welfare is given by $W_b(\beta)$. Thus, the $\dot{\beta} = 0$ locus here is the W_b curve. We can see that the steady state is close to that shown in figure 3(a) for the analogous static problem.

This finding is general. In the appendix, we show that the steady state solution to the optimal control problem satisfies

$$\frac{V(\beta^{ss})}{(1-\beta^{ss})V'(\beta^{ss})} = \left(1 + \frac{\rho}{f'(0)}\right), \tag{12}$$

where β^{ss} denotes the steady state level of banditry.[50] The steady state tax level, $T^{ss} = -V(\beta^{ss})$. The first order condition for the analogous static tax problem is expression (4a) with $M = 0$. Comparing these expressions (see appendix for details),we see that the steady state of the dynamic problem yields higher banditry, higher tax and (hence) lower popular welfare than the static problem. As the king becomes more patient (that is, as ρ approaches 0), however, the steady state approaches the static solution; hence figure 6(b). An intuition for the higher tax in the dynamic case is that the static solution is the top of a smooth Laffer curve. Suppose, counter-factually, that the steady state tax was at this same point. Since it is a steady state, tax expectations are realized. Now consider a small, once and for all, tax increase. In the first period, the king makes a first order gain by surprising the populace. In the long run, expectations catch up and per period tax revenues are reduced. But, since we started at the top of the Laffer curve, the reduction in per period revenues is only second order. Hence, provided there is some discounting, the dynamic optimum can not be at the top of the Laffer curve. The solution needs to be 'on the way down' the curve for there to be sufficient long-run incentives not to raise taxes. As the king becomes more patient, the long-run incentives figure larger and the solution can be nearer the top of the curve.

Thus, in our model, if a king has a short time horizon, perhaps because he is insecure, then we would predict a period of high tax, high crime and low welfare.[51] Conversely, as in McGuire & Olson's (1996) model, output and popular welfare increase as the king becomes

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[50] In the appendix, we show that the steady-stage is a saddlepoint provided that $\frac{-1}{V'(\beta^{ss})(1-\beta^{ss})}\frac{f'(0)}{f''(0)} < 2$; that is, loosely speaking, provided the adjustment rule f is sufficiently convex. Both the examples shown in figure 6 satisfy this condition.

[51] Grossman & Noh's (1990) model yields a similar relation between tax rates and the security monarchal tenure. This finding agrees with Barzel's (1992) and Olson's (1993) intuitions.

more patient or his time horizon increases. In our model, however, even a very long-lived king is not much cause for optimism. At best, popular welfare is no higher than the low levels we found in the static version of the model.

Since we only have one state, we can not properly model wars. We can, however, use our dynamic model to consider the effects of fiscal crisis that often accompany wars. Suppose that the king has to raise more than steady state revenue for a period of time: perhaps, he has to supply a crusade. To keep things simple, suppose that he can not store resources so he must have a higher revenue flow during the crisis period. At each moment, revenues are $(1-\beta)T$. So, in figure 6(a), iso-revenue lines are hyperbolae.. Let the king's revenue flow constraint be shown by the higher iso-revenue line H^+. At the start of the crusade funding crisis, the king will raise taxes such that revenues meet his constraint: that is, starting from the steady-state, taxes will jump up to the hyperbola H^+. Gradually, as the populace come to expect the higher tax burden on the peasantry, more will become bandits. To keep his revenue constant, the king will have to raise tax even further, sliding up the hyperbola H^+ to the north east. At the end of the crisis, the king will drop taxes down to the saddle path, and gradually both taxes and banditry will return to their steady state levels. In the case shown, this re-adjustment involves overshooting; that is, taxes will fall below their steady state level immediately after the crusade crisis.

The model thus predicts that war will be accompanied by an increase in banditry and that this increased banditry will persist a while after the war is over. It is notable that medieval England's most famous bandit, Robin Hood, lived during the high tax burdens associated with the crusades. Perhaps, folklore remembered a period when taxes and banditry were both high and supplied a more romantic story of how one caused the other.[52] It would be interesting to know whether medieval wars were generally periods of high banditry and also whether taxes were exceptionally low immediately after such crises.

6 Appendix

Proofs for Section 2.1 To show that $V'(\beta) < 0$. Notice that the resource equation can be written as $\beta V(\beta) = R(\beta) - W_p(\beta)$. Differentiating then multiplying through by β gives $-\beta^2 V'(\beta) = -\beta R'(\beta) + \beta W_p'(\beta) + \beta V(\beta)$. Substituting $\beta V = R - W_p$ and rearranging gives

$$-\beta^2 V'(\beta) = \beta[W_p'(\beta) - R'(\beta)] - [W_p(\beta) - R(\beta)]$$

[52] For an alternative view of Robin Hood, see Grossman (1995b).

$$= \int_0^\beta \left[[W_p'(\beta) - R'(\beta)] - [W_p'(\beta') - R'(\beta')] \right] d\beta' > 0$$

since the integrand is strictly positive by assumption A5. ■

Proofs for Section 2.2 The bandit chief's problem is to choose a tribute level T_b to maximize revenue $\max_{T_b} \beta T_b$ subject to the constraints $W_b(\beta) - T_b(\beta) = W_p(\beta)$ and $T_b \leq M$ (and $\beta \in [0,1]$). We can use the first constraint to eliminate T_b from the problem, giving $\beta V(\beta)$ as the objective function. The resource equation (1) gives

$$\beta V(\beta) = R(\beta) - W_p(\beta) \tag{13}$$

which is concave by A5. Since the remaining constraint, $V(\beta) \leq M$, is (trivially) quasi-concave, the chief's problem has a unique solution given by the first order condition, as claimed in Section 2.1. Either the constraint does not bind and we have equation (3a) (or (3b) using (13)), or it does bind, in which case it gives the outcome.

Proofs for Section 3 The king's problem is to choose a tax level T_p to maximize revenue $\max_{T_p}(1-\beta)T_p$ subject to the constraints that $W_b(\beta) - M = W_p(\beta) - T_p$ and $T_p \leq W_p(\beta)$ (and $\beta \in [0,1]$). Again, we can eliminate T_p from the problem, which becomes max $\beta(1-\beta)(M - V(\beta))$ subject to $W_b(\beta) - M \geq 0$. And using the resource equation (1) again, we have

$$(1-\beta)(M - V(\beta)) = (1-\beta)M + R(\beta) - W_b(\beta) \tag{14}$$

which is concave by assumption A5, while the remaining constraint, $W_b(\beta) \geq M$ is (trivially) quasi-concave.. So again this problem has a unique solution, given by the first order condition. Either the constraint does not bind and we have equation (4a) (or (4b) using (14)), or it does bind and gives the outcome directly.

The comparative static equations (5) and (6) are obtained using the first order conditions, via the implicit function theorem and some algebraic manipulation.

Proofs for Section 4.1 Formally the King's problem is as in Section 3.1 with the same constraints, but an extra (linear) term in the objective function, which is now $\max_{T_p}(1-\beta)T_p + \beta M$. The same analysis goes through, giving the equivalent problem $\max(1-\beta)(M - V(\beta)) + \beta M$ subject to $W_b(\beta) \geq M$, which has equation (7) as the (interior) first order condition.

Proofs for Section 4 We first derive the properties of the reaction curves and the curves r_p and r_b. We can think of the bandit chief taking T_p as given and (implicitly) choosing β to maximize βT_b subject to

$$T_b = V(\beta) + T_p \tag{15}$$

Since we are only interested in the interior, we can ignore the other constraints. As usual, we can write the first order condition in two mutually equivalent ways,

$$\beta V'(\beta) = -T_b \tag{16a}$$

$$R'(\beta) - W_p'(\beta) = -T_p \tag{16b}$$

where (16b) is derived using (1), the resource identity. To describe the curve r_b, first totally differentiate (16b) to yield

$$\frac{\partial \beta}{\partial T_p} = \frac{-1}{[R''(\beta) - W_p''(\beta)]} > 0 \tag{17}$$

where the inequality follows from assumption A5. The change in popular welfare along r_b is given by

$$\frac{\partial}{\partial T_p}(W_p(\beta(T_p)) - T_p) = W_p'(\beta(T_p)) \cdot \frac{\partial \beta}{\partial T_p} - 1 < 0 \tag{18}$$

where the inequality follows from (17) and assumption A3.

Similarly, we can think of the king taking T_b as given and (implicitly) choosing β to maximize $(1-\beta)T_p$ subject to (15). Again, since we are only interested in the interior, we can ignore the other constraints. The (mutually equivalent) first order conditions are

$$(1-\beta)V'(\beta) = -T_p \tag{19a}$$

$$R'(\beta) - W_b'(\beta) = T_b \tag{19b}$$

Therefore, the king changes his (implicit) choice of β as T_b is increased according to

$$\frac{\partial \beta}{\partial T_b} = \frac{1}{[R''(\beta) - W_b''(\beta)]} < 0 \tag{20}$$

where the inequality again follows from assumption A5. In this case, however, the change in popular welfare along r_p,

$$\frac{\partial}{\partial T_b}(W_b(\beta(T_b)) - T_b) = W_b'(\beta(T_b)) \cdot \frac{\partial \beta}{\partial T_b} - 1 \tag{21}$$

cannot be signed. Notice that the right side of (21) is analogous to expression (5), describing the welfare effect of increasing the king's ability to harm bandits. The explicit functional examples given there apply also in this case.

It is also useful to know how the king's choice of T_p changes as T_b is increased. Differentiating the constraint (15) and using (20) yields

$$\frac{\partial T_p}{\partial T_b} = 1 - \frac{V'(\beta)}{R''(\beta) - W_b''(\beta)} \tag{22}$$

To sign this expression, differentiate the resource identity (1) twice and rearrange to get

$$R''(\beta) - W_b''(\beta) = V'(\beta) + [V'(\beta) - (1-\beta)V''(\beta)] \tag{23}$$

By assumptions A3 and A5, the bracketed term on the right of (23) is negative. Therefore $R''(\beta) - W_b''(\beta) < V'(\beta)$ which is, itself, negative. Hence the second term on the right of (22) is less than one. That is, the kings best response T_p is increasing in T_b.

Uniqueness. We are now ready to prove that there is at most one interior equilibrium. Suppose that both β_1 and β_2, are equilibrium levels of banditry, with $\beta_1 < \beta_2$. Then, each must satisfy both conditions (16b) and (19b). Let T_{p1}, T_{p2}, T_{b1}, and T_{b2}, be the corresponding tax and tribute values. By (16b) and assumption A5, we have $T_{p1} < T_{p2}$. Similarly, by (19b) and assumption A5, we have $T_{b2} < T_{b1}$. But we have just shown that the king's choice of T_p is increasing in T_b, so it cannot be the case that both β_1 and β_2 are equilibria.

The level of banditry. The claim that $\beta_B^* < \beta_D^* < \beta_E^*$ follows from (17) and (20). Combining the first order conditions (16a) and (19a) yields expression (9). In equilibrium, by (8), we have $W_p(\beta_D^*) - T_p^* = W_b(\beta_D^*) - T_b^*$; while, by $V' < 0$, we have $W_p(\beta_D^*) > W_b(\beta_D^*)$ if and only if $\beta_D^* > \beta_A^*$. Therefore $\beta_D^* > \beta_A^*$ if and only if $T_p^* > T_b^*$. Using expression (9), this implies that $\beta_D^* > \beta_A^*$ if and only if $\beta_D^* < (1-\beta_D^*)$; that is, if and only if $\beta_D^* < \frac{1}{2}$.

Popular welfare. From (18), we know that $w_D^* < w_B^*$. If $\frac{1}{2} > \beta_A^*$ then $\beta_D^* > \beta_A^*$, so (by assumption A3) $w_B^* = W_p(\beta_D^*) - T_p^* < W_p(\beta_A^*) = w_A^*$. Similarly, if $\frac{1}{2} < \beta_A^*$ then $\beta_D^* > \frac{1}{2}$, so $w_B^* < W_p(\frac{1}{2})$.

Revenue. The fact that the king's revenue is higher than in the absence of the bandit chief follows from applying the envelope theorem to the king's maximization problem with respect to the parameter T_b. More directly, increasing T_b relaxes a constraint in the king's problem. Similarly, increasing T_p relaxes a constraint in the bandit chief's problem. If $\frac{1}{2} < \beta_A^*$ then $(1-\beta_D^*) < \beta_D^*$ and $T_b^* > T_p^*$; that is, the bandit chief's revenues exceed those of the king in this case.

Proofs for Section 5 We will begin by solving for the steady state, and leave it to the reader to check that any solution to the king's problem not converging to the steady state is sub-optimal. The existence of an optimal solution can be proved using Theorem 10 in Seierstad and Sydsaeter (1987, p.384).

It is convenient to make β the state variable. Equation (10) implies that

$$\dot{\beta} = g(\beta, T) \equiv \frac{-f(T + V(\beta))}{V'(\beta)} \tag{24}$$

We can write the current value Hamiltonian $\tilde{H}(T,\beta,\nu) \equiv (1-\beta)T + \nu g(\beta,T)$ and derive "first order conditions" for the optimal path in the usual way. The maximum principle implies (since we assume f convex)

$$(1-\beta)+\nu g_T(\beta,T)=0 \tag{25}$$

while the costate equation is

$$\dot{\nu}-\rho\nu=-\left[-T+\nu g\beta(\beta,T)\right] \tag{26}$$

To obtain steady state values we set $\dot{\beta}=\dot{T}=0$ (so, by (25) we have $\dot{\nu}=0$). From (24) we have $T^{ss}+V(\beta^{ss})=0$. We can use (25) to eliminate ν from (26), and also to calculate g_T and $g\beta$ explicitly:

$$g_T(\beta^{ss},T^{ss}) = \frac{-f'(0)}{V'(\beta^{ss})} \tag{27a}$$

$$g\beta(\beta^{ss},T^{ss}) = -f'(0) \tag{27b}$$

Putting these together gives (12) as claimed. Now, the left side of (12) is an increasing function of β^{ss} (to see this, differentiate and use the facts that $V'<0$ and $V''>0$ by Assumption A5, while $V(\beta^{ss})=-T^{ss}<0$).

It follows that β^{ss} is increasing in ρ and decreasing in $f'(0)$, and also that β^{ss} is greater than $\beta_E^*(0)$ from the analogous static problem, since that has first order condition (4a), which (for $M=0$) can be written as:

$$\frac{V(\beta)}{(1-\beta)V'(\beta)}=1 \tag{28}$$

Since $T^{ss}=-V(\beta^{ss})$ and steady-state popular welfare is given by $W_b(\beta^{ss})$, the other comparative static properties discussed in Section 5 are immediate consequences of the above.

The Phase diagrams. We can learn more about the dynamics by examining a phase diagram in (β,T)-space, as in figure 6(a). The $\dot{\beta}=0$ locus is given (from (24)) by $\dot{T}=-V(\beta)$. To get the locus $\dot{T}=0$ we totally differentiate (25) with respect to time, then eliminate ν and $\dot{\nu}$ using (25) and (26), respectively, giving (omitting all arguments):

$$g-Tg_T+(1-\beta)(\rho-g\beta)+(1-\beta)g\frac{g_{T\beta}}{g_T}=0 \tag{29}$$

Totally differentiating (29) with respect to time and substituting in steady-state values (which are: $g^{ss}=0$, $g\beta^{ss}=-f'(0)$, $g_T^{ss}=-f'(0)/V'(\beta^{ss})$, $g_{\beta\beta}^{ss}=-f''(0)V'(\beta^{ss})+f'(0)V''(\beta^{ss})/V'(\beta^{ss})$, $g_{\beta T}^{ss}=-f''(0)+f'(0)V''(\beta^{ss})/(V'(\beta^{ss}))^2$, $g_{TT}^{ss}=-f''(0)/V'(\beta^{ss})$,and $T^{ss}=-V(\beta^{ss})$) gives

$$\left.\frac{dT}{d\beta}\right|_{\dot{T}=0}=-\frac{-(2f'(0)+\rho)+V(\beta^{ss})(f'(0)V''(\beta^{ss})/V'(\beta^{ss})^2-f''(0))}{-f''(0)V(\beta^{ss})/V'(\beta^{ss})} \tag{30}$$

at the steady state. So the $\dot{T} = 0$ locus slopes downward near the steady-state if and only if the numerator in this expression is negative. Clearly a sufficient condition for this is

$$\frac{f''(0)}{f'(0)} < \frac{V''(\beta^{ss})}{V'(\beta^{ss})^2}. \tag{31}$$

Local Behavior and the Steady State. We would like to show that the steady state of our dynamical system has the saddle-point property; that is, that in an open neighborhood of the steady state there is a one-dimensional submanifold on which the system converges to the steady state. In order to do so, it is convenient to rewrite the problem using T^e as our state variable and defining a new costate variable μ.[53]

$$\begin{aligned} &\max_{T,T^e} \int_0^\infty e^{-\rho t} T(1-\beta(T^e))dt \\ \text{s.t.} \quad \dot{T}^e &= f(T - T^e) \end{aligned}$$

where $\beta(T^e)$ is defined implicitly by $T^e = -V(\beta)$. The current value Hamiltonian becomes $\tilde{H} = T(1-\beta(T^e)) + \mu f(T - T^e)$ and the first order conditions are

$$1 - \beta(T^e) + \mu f'(T - T^e) = 0 \tag{32a}$$

$$\dot{T}^e = f(T - T^e) \tag{32b}$$

$$\dot{\mu} - \rho\mu = T\beta'(T^e) + \mu f'(T - T^e) \tag{32c}$$

If we use (32a) to eliminate T, and also to substitute for the $\mu f'$ term in (32c), we can express the dynamical system as equation (32b) together with

$$\dot{\mu} = \rho\mu + T\beta' - 1 + \beta \tag{33}$$

A sufficient condition for the saddle-point property is then that the Jacobian of (32b) and (33), evaluated at the steady state, have negative determinant. This Jacobian is given by

$$J = \begin{bmatrix} f'(0)(\partial T/\partial T^e - 1) & f'(0)(\partial T/\partial \mu) \\ (\partial T/\partial T^e + 1)\beta' + T\beta'' & \rho + (\partial T/\partial \mu)\beta' \end{bmatrix} \tag{34}$$

Implicit differentiation of (32a) gives

$$\frac{\partial T}{\partial \mu} = \frac{-f'}{\mu f''} > 0 \tag{35a}$$

$$\frac{\partial T}{\partial T^e} - 1 = \frac{\beta'}{\mu f''} < 0 \tag{35b}$$

[53] This is (equivalent to) no more than a change in the coordinates used to describe our manifold ($\mu \equiv -\nu/V'(\beta)$), which is clearly legitimate since the saddlepoint property is independent of the coordinate system used.

Since $\beta' = -1/V' > 0$, and $\beta'' = -V''/V'^3 > 0$, we can sign three of the entries in J ($J_{11} < 0$, $J_{12} > 0$, $J_{22} > 0$), so a sufficient condition for the determinant to be negative is $J_{21} > 0$. If we evaluate J_{21} (using $T^{ss} = -V(\beta^{ss})$ and $\mu^{ss} = -(1 - \beta^{ss}/f'(0))$ we get

$$-V'(\beta^{ss})J_{21} = \frac{-V(\beta^{ss})V''(\beta^{ss})}{V'(\beta^{ss})^2} + \left[2 + \frac{f'(0)}{f''(0)(1-\beta^{ss})V'(\beta^{ss})}\right] \tag{36}$$

the first term on the right of (36) is positive since $V'' > 0$ and $V(\beta^{ss}) = -T^{ss} < 0$. So a sufficient condition for J_{21} to be positive is that

$$f''(0) > -\frac{f'(0)}{2(1-\beta^{ss})V'(\beta^{ss})} \tag{37}$$

Recall from (12) that β^{ss} (and so the whole right side of (37)) is a function of $f'(0)$ only. Thus, for any given $f'(0)$, we have the saddle-point property provided $f''(0)$ is sufficiently large.

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