IMF Working Paper

WP/99/127

INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

The Enforcement of Property Rights and Underdevelopment

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September 1999

Abstract

This paper formalizes the role of legal infrastructure in economic development in a general equilibrium model with endogenously determined property rights enforcement. It illustrates the mutual importance of property rights protection and market production by the model's multiplicity of equilibria. In one equilibrium, property rights are enforced and market activity is unhampered. In the other, property rights are not enforced, which discourages economic activity and leaves the economy without the resources and incentives to enforce property rights. Even identically endowed economies may therefore find themselves in very different equilibria.

JEL Classification Numbers: D23, O41

Keywords: Property rights, multiple equilibria, expropriation, development

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I. INTRODUCTION

One of the greatest puzzles in all of economics and certainly the puzzle with the greatest impact on welfare is the gap between rich and poor economies. Are underdeveloped economies merely smaller or younger versions of developed economies or are there significant differences in the form of political and economic interactions that account for the wide gap in economic performance?

One difference cited by economists as far back as Adam Smith (1776) lies in the legal systems of developed and undeveloped economies. As North (1990) puts it, "the inability of societies to develop effective low-cost enforcement of contracts is the most important source of historical stagnation and contemporary underdevelopment in the Third World."[1] It is easy to imagine how a poorly developed legal system prevents economies from developing. Without the enforcement of property rights, participation in some market activity is discouraged by the prospect that anyone engaging in such activity is unlikely to receive its full benefits. Any expropriation of the proceeds of market activity by dishonest parties to a contract, bandits, or corrupt government officials, is therefore likely to reduce incentives and opportunities for production, investment, and innovation.[2]

A more difficult question is why any economy, knowing the consequences, would permit imperfect property rights. Are some nations poor and without effective property protection simply because they face much greater costs of defining or enforcing property rights? A theory that starts from the assumption that some countries exogenously have more naturally "honest" citizens or greater enforcement skills would not go very far in increasing our understanding of the barriers to development. We need our theory to explain not only the harm from an ineffective legal system but also why some nations do not willingly pay the costs that others seem willing to incur in order to improve their legal system.

In this paper, the protection of property rights is studied in a general equilibrium model in which even the degree of enforcement effort is endogenously determined. We explain the observed differences in the realized enforcement of property rights as different equilibria in otherwise identical economies: either the expropriation of the property of others is rampant and causes the conditions that prevent the enforcement of property

[1] North and Thomas (1973), in a historical study, review the importance of property rights in explaining the growth performance of Western economies. Nations like England, in which the power of the state is forced by the rule of law to maintain property rights, are seen to grow faster than France or Spain because private agents are freed from the fear of expropriation of their returns from economic activity.

[2] Recent cross-country empirical studies by Mauro (1995) and Keefer and Knack (1995) find that the security of property rights is positively and significantly associated with economic growth. See also Tanzi (1997, 1998).

rights, or property rights are generally well respected and in the resulting prosperous equilibrium few wish to attempt to expropriate the property of others.

We develop a simple model of the interaction between productive economic activity, expropriation, and its deterrence. In the model, enforcement of property rights is needed in order to encourage productive market activity. The degree of this enforcement is chosen collectively by optimizing agents interested in protecting their return from production. We can think of the government as the agent assigned the task of enforcing this collective choice, with taxation being the means of enforcement.[3] The model displays two distinct equilibria – one "rich," characterized by enforcement of property rights, a low level of expropriation, and a high level of economic activity; and one "poor," in which property rights are insecure, which discourages economic activity and, in turn, limits the ability and the will of the agents to enforce property rights.

This paper is related to various strands of research. Murphy, Shliefer, and Vishny (1993), Tirole (1993), Andvig and Moene (1990), and Lui (1986) all derive models with multiple equilibria in expropriation or rent seeking. Each, however, generates its multiple equilibria given arbitrary limits on the enforcement efforts: Murphy, Shliefer, and Vishny(1993), and Tirole (1993) assume there can be no detection of wrong doing; Andvig and Moene (1990) assume that detection is exogenous and random; and Lui (1986) assumes that the amount that can be spent on enforcement is exogenously fixed. None of these papers, therefore, examines the unrestricted determination of enforcement effort.[4] In contrast, we explicitly focus on unrestricted decisions of how vigorously to enforce property rights. An important feature of our model is that it may display multiple equilibria even when agents are optimizing in their unrestricted choice of enforcement. In this sense the model is similar to microeconomic models of multiple equilibria involving illegal behavior like corrupt tariff determination in Brock, Magee, and Young (1989), uninsured motoring in Smith and Wright (1992), or neighborhood thievery in Freeman, Grogger, and Sonstelie (1996).

One extension to the basic model examines the issue of private enforcement of property rights. We show that without collective action, the individual incentive to enforce property rights and discourage expropriation is related to the number of predators a productive agent must deal with. Private enforcement is most effective when the costs to

[3]It is well known that the collection of revenue for the provision of public goods offers its own challenges to economic development. The paper intentionally abstracts from differences among countries in their abilities to enforce collective choices in order to focus on the model's special features concerning enforcement itself.

[4]A related paper by Grossman and Kim (1996) develops a dynamic model of expropriation without multiple equilibria in which the security of property rights and capital accumulation are endogenously determined. Their analysis focuses on guarding against predators, while our paper focuses on the apprehension of predators. Presumably, the two strategies are complementary.

reducing the variety of contacts with predators are minimal.[5] Another extension examines the possibility of development traps and take offs. We show that enforcement costs can generate a threshold below which market activity is impaired, thus, contributing to the gap between rich and poor economies.

In section II, we lay out the model and characterize its equilibria. We then discuss some properties of these equilibria in section II.C. In section III, we examine several related issues: private enforcement of property rights and the possibility of development traps. Section IV concludes.

II. MODEL

A. Environment and Technology

Consider an economy populated by a continua of measure 1 of two types of people – producers and predators. The relations between predators and producers may be interpreted in various ways. It is easiest to think of predators as those who are able to steal market production. In this case, the enforcement of property rights entails enforcing laws against theft. A related interpretation would define predators as corrupt elements of the government – perhaps police, soldiers, or bureaucrats – that use their power over public commerce to solicit bribes or otherwise acquire wealth.[6]

Each producer is endowed with y units of nonstorable time, which can be divided between leisure and the production of a consumption good.[7] The utility of a producer is described by a twice continuously differentiable quasiconcave function $U(h, c)$ of its nonnegative leisure, h, and consumption, c, respectively. The arguments of the utility function are gross substitutes. The first derivative u_h of $U(h, c)$ is infinite for $h = 0$. The first derivative u_c of $U(h, c)$ is finite for $c \geq 0$.

A producer produces $f(k)$ units of the consumption good from k units of time, where $f(\cdot)$ is a continuously differentiable, increasing, concave function with $f(0) = 0$. Inputs to production are unobservable to others at the time of the input decision, which implies that producers cannot coordinate their input decisions. To produce goods, each producer

[5] Posner(1998) notes that while family alliances and other methods of self-protection may be substitutes to legally enforceable rights, these are costly in the context of a modern economy.

[6] One might also think of the two groups as parties to private contracts for production. As the model is presented, however, it is closer to a model of theft or expropriation than of reneging on contracts because it does not assume any disutility to predatory behavior. Such an assumption is easily added to the model, but the paper proceeds with the simpler model of expropriation.

[7] What we call leisure may be thought of as any good that is safe from expropriation, or is at least safer from expropriation than is the other good. Home production may be another example.

must deal with the entire continuum of predators, thus exposing an equal share of its market production to the grasp of each predator.

A predator has the power to expropriate all output falling under its control and attempt to flee from the economy.[8] Given that there are a continua of equal measure of producers and predators, each predator can expropriate a total of $f(k)$ goods but only an infinitesimal amount of output from any single producer. Predators cannot coordinate their expropriation of market output and the leisure or nonmarket output of producers cannot be expropriated.[9]

A predator who doesn't expropriate consumes zero goods and has a utility of zero. The utility of a predator who expropriates depends on whether or not the predator is apprehended. If caught it must return all goods misappropriated and suffers an additional punishment (imprisonment, corporal, or capital punishment) lowering its utility by z units, where z is finite.[10]A predator seeks to maximize its expected utility, which is the expected value of its consumption minus any punishment. An expropriating predator, therefore, has a utility of $-z$ if caught and $f(k)$ if not caught.

Let n denote the fraction of predators that attempt to expropriate market output and flee from the economy. After predators have attempted to flee, producers collectively choose the number of predators to apprehend, m. Because each producer has lost only an infinitesimal fraction of its output to any single predator, no producer will want to pay enforcement costs on its own. Each of the identical producers pays an equal fraction of the cost of enforcement.[11]

A small measure of expropriating predators can evade capture each period regardless of enforcement efforts. Let $\mu > 0$ denote this measure.[12] If more than μ predators expropriate, $m \leq n - \mu$ may be caught at a total cost of $\Gamma(m)$ goods, where $\Gamma(\cdot)$ is a continuously differentiable, increasing convex function with $\Gamma(0) = 0$. It follows that the probability π that any given expropriating predator is successfully apprehended is given by[13]

[8] An alternative assumption that producers can observe only the flight of predators but not the amount taken is equivalent in its effect to the assumption that a predator takes all output in its control. Notice also that a predator cannot expropriate the goods controlled by another.

[9] Coordinated expropriation is studied elsewhere. See, for example, Grossman (1991) or Marcouiller and Young (1995).

[10] Note that if z were zero, expropriation would always be at its maximal value.

[11] This follows from the assumption that there are a continua, each of measure one, of producers and predators. This assumption is altered in section III, where the implications of privately financed enforcement decisions are studied.

[12] This assumption allows us to rule out certain capture and ensures us of an equilibrium with positive levels of expropriation. For an equilibrium with $\mu = 0$, see section 3.

[13] This enforcement technology is derived from an idea of Jon Sonstelie's and was applied to the

$$\pi = \begin{cases} \frac{m}{n} & \text{if } n > \mu \\ 0 & \text{if } n \leq \mu \end{cases} \tag{1}$$

Since the number of predators that are apprehended cannot exceed the number of predators that choose to expropriate ($m \leq n - \mu$), equation (1) implies that π is strictly less than one, for all $\mu > 0$. In addition, the probability that any expropriating predator is successfully apprehended is zero for all $n \leq \mu$.

B. Equilibria

Let k denote the period 1 allocation of time to production by each producer. (Since the measure of producers and predators is the same, k also represents the inputs to production under the control of each predator.) A subgame perfect Nash equilibrium is then defined as values of m, k, and n consistent with the following sequence of decisions:

1. each producer individually chooses its input to production k to maximize its utility, taking as given the behavior of the predators;

2. each predator decides whether or not to expropriate in order to maximize expected utility, taking as given the behavior of the other predators;

3. producers collectively choose the number m of predators to apprehend taking as given the behavior of the predators.

The sequence of decisions is illustrated in the game tree of Figure 1. As usual, we find subgame perfect Nash equilibria by examining agents' decisions in reverse order.

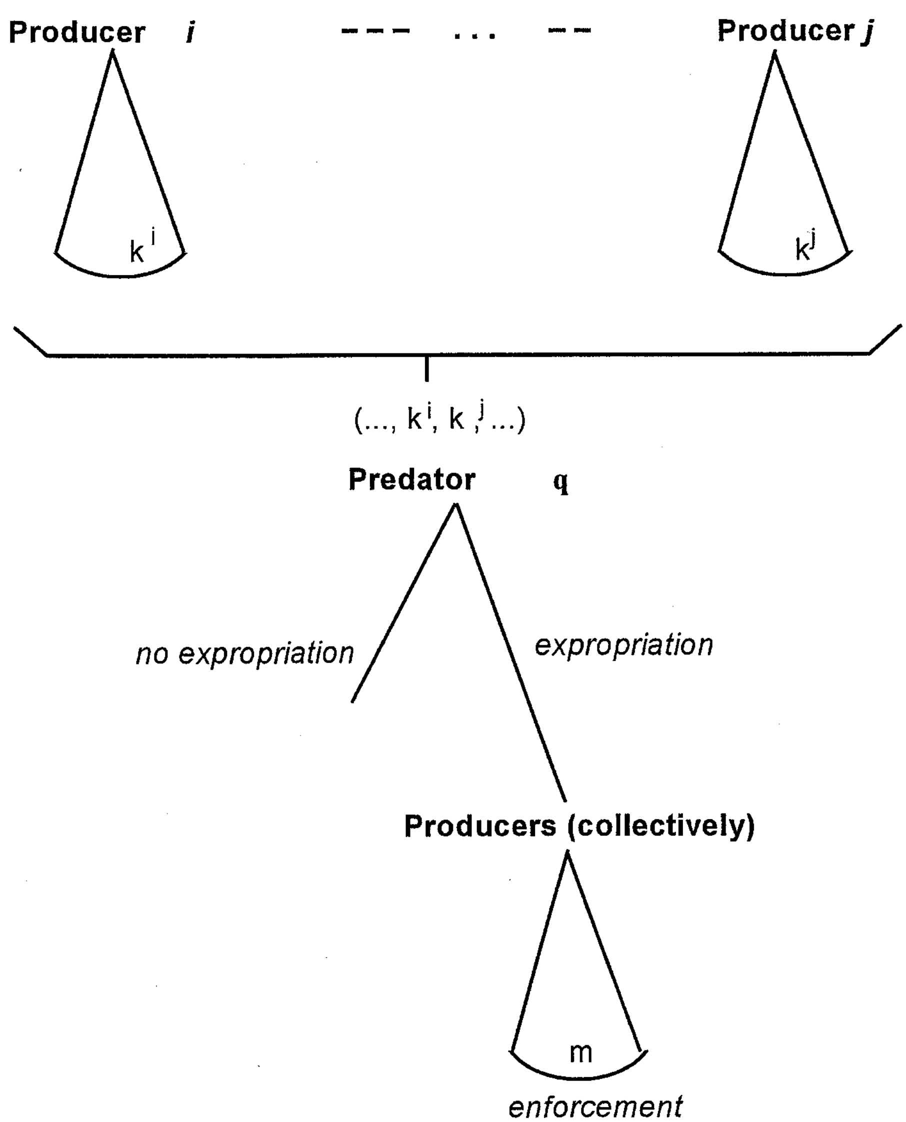
The enforcement decision (iii) is simple. If $n \leq \mu$, no expropriating predators can be caught so there is no reason to spend resources on enforcement. If $n > \mu$, producers choosing to apprehend m predators will reclaim $mf(k)$ goods from the m apprehended predators at a cost of $\Gamma(m)$ units of the consumption good. Therefore, producers choose m, to maximize $[mf(k) - \Gamma(m)]$ taking the input k as given. The first order condition defining an interior maximum is given by

$$\begin{aligned} f(k) - \Gamma'(m) &= 0 \qquad \text{for} \qquad 0 < m \leq n - \mu \\ f(k) - \Gamma'(m) &\leq 0 \qquad \text{for} \qquad m = 0 \end{aligned} \tag{2}$$

Equation (2) states that in an interior equilibrium, with $m > 0$, producers will collectively choose to apprehend predators up to the point where the value of goods retrieved from each apprehended predator equals the marginal cost of enforcement. Although enforcement is a public good, collectively chosen by producers, there is no disagreement

question of the concentration of street crime in Freeman, Grogger, and Sonstelie (1996).

Figure 1: The Game Tree



about its provision because all producers face the same losses and pay the same fraction of the enforcement costs.

The solution to this problem implicitly defines m as a function of the units of time devoted to production, $m = \hat{m}(k)$ such that

$$\frac{\partial \hat{m}}{\partial k} = \frac{f'(k)}{\Gamma''(m)} > 0 \text{ for } \quad 0 < m \leq n - \mu \tag{3}$$

$$m = 0 \text{ if } f(k) < \Gamma'(0) \tag{4}$$

Equation (3) states that the greater the value of output, the greater the effort to protect that output from expropriation.

The decision of each predator (ii) strongly depends on the decisions of the other predators as well as on the anticipated enforcement effort, $\hat{m}(k)$. Recall that an expropriating predator has a utility of $-z$ if caught and $f(k)$ if not caught. Let V denote the expected return to expropriation as a function of n, m and k.

$$V = (1-\pi)f(k) - \pi z \quad = \quad \left[1 - \frac{m}{n}\right] f(k) - \frac{m}{n} z \tag{5}$$

Because a predator who doesn't expropriate consumes zero goods, predators will choose to expropriate only if $V \geq 0$. Notice that the return to expropriation, V, is increasing in n, for given m and k, since the probability of apprehension for any given predator falls with increases in n for $n > \mu$. That is, a larger number of expropriating predators makes it more likely that any single predator can avoid capture.[14]

The input decision (i) of producers is standard. The expected return to the input k is a function of enforcement effort, m, and the measure of expropriating predators, n. Because each producer deals with the entire continuum of predators, it receives $f(k)$ from each of $(1-n)$ predators who choose not to expropriate and $\pi n (= \frac{m}{n} n = m)$ apprehended expropriating predators. Each producer faces the budget constraints

$$y = h + k \tag{6}$$

$$(1 - n + m)f(k) = c + \Gamma(m) \tag{7}$$

A producer choosing inputs, k, to maximize personal utility, taking m and n as given, will obey the first order Kuhn-Tucker condition

$$u_h\,(y-k) - [1-n+m]\, f'(k) u_c\,((1-n+m)f(k) - \Gamma(m)) = 0 \tag{8}$$

[14]Expropriating predators provide each other with a positive externality by giving the enforcement effort more targets, thus, reducing the chance that each will be caught. In our model, this externality does not arise from a direct assumption about the enforcement technology. In particular, an increase in the number of predators neither increases the unit cost of catching a predator [as in Lui (1986)], nor decreases the severity of punishment [as in Andvig and Moene (1990)]. See also Bardhan (1997).

Equation (8) states that in an interior equilibrium, production is undertaken until the marginal rate of substitution equals the marginal return on production. The first order condition, (8) together with the function $\hat{m}(k)$ implicitly defines k as a function of n

$$k = \hat{k}(n) \tag{9}$$

with

$$\frac{\partial \hat{k}}{\partial n} = \frac{-\left[f(k)f'(k)(1-n+m)u_{cc} + f'(k)u_c\right]}{\lambda - \frac{\partial \hat{m}}{\partial k}\left[f(k)f'(k)(1-n+m)u_c c\} + f'(k)u_c + \Gamma'(m)f'(k)u_c\right]} < 0 \tag{10}$$

where

$$\lambda = -u_{hh} - \left(f'(k)\right)^2(1-n+m)u_{cc} + f"(k)(1-n+m)u_c > 0$$

An increase in the number of expropriating predators discourages productive effort by increasing the likelihood of expropriation of one's output. Because enforcement effort m is an increasing function of k, it follows that increases in expropriation, by discouraging productive effort, leave the economy with less incentive for enforcement effort.

We can now use (2) and (8) to describe the return to expropriation as a function of n:

$$V(n) \equiv V(n, \hat{m}(\hat{k}(n)), \hat{k}(n)) \tag{11}$$

At this point let us establish some properties of the function $V(n)$ in order to characterize the nature and number of possible equilibria.

Lemma 1 *There is always a positive amount of expropriation in equilibrium* $[V(n) > 0 \ at\ n = 0]$.

Proof: For $n \leq \mu$, the desired enforcement effort and the probability of capture is zero ($\pi = 0$) while positive investment occurs, $\left[f(\hat{k}(0)) > 0\right]$. Having nothing to fear, predators will want to expropriate from producers, implying that $n = 0$ is not an equilibrium. *Q.E.D.*

Equilibrium values of $n > \mu$ must satisfy one of two conditions:

$$V(n) = \begin{cases} \left[1 - \frac{\hat{m}(\hat{k}(n))}{n}\right] f(\hat{k}(n)) - \left[\frac{\hat{m}(\hat{k}(n))}{n}\right] z = 0 & \text{for some } n > \mu \\ \left[1 - \frac{\hat{m}(\hat{k}(n))}{n}\right] f(\hat{k}(n)) - \left[\frac{\hat{m}(\hat{k}(n))}{n}\right] z \geq 0 & \text{for } n = 1 \end{cases} \tag{12}$$

that is, in an interior equilibrium ($0 < n < 1$), predators must be indifferent between expropriating and not expropriating, and in an equilibrium in which all expropriate, the return to expropriation must exceed that of not expropriating.

The return to expropriation is affected in conflicting ways by the number of predators who choose to expropriate. As established in (9), an increase in the number of active predators lowers investment, decreasing the take from each act of expropriation. On the other hand, the lower investment reduces the enforcement effort required to protect that investment, thus decreasing the probability of capture, $\frac{\hat{m}(\hat{k}(n))}{n}$ (the numerator falls). Further decreasing the probability of capture is that the increased number of expropriating predators reduces the chance that each will be the one caught by the enforcement effort (a reduction in the denominator of $\frac{\hat{m}(\hat{k}(n))}{n}$).

Note that it is possible that $V(n) > 0 \;\forall\; 0 < n < 1$. Such a situation may arise if, for example, the expected punishment from engaging in expropriation is low (low z). In this case, we have a unique stable equilibrium with complete expropriation ($n = 1$) as described above.

It is also possible to establish conditions independent of the value of z such that there exists an equilibrium of total expropriation ($n = 1$).

Lemma 2 *If* $\lim_{(1+m-n)\to 0}\left[\hat{k}(n)\right] = 0$ *and if* $\Gamma'(0) > 0$, *then there always exists an equilibrium of total expropriation* ($n = 1$).

Proof: At $n = 1 - \epsilon$, and ϵ tends to zero $f(\hat{k}(n))$ is positive but increasingly small. Once $f(\hat{k}(n))$ is less than the marginal cost of apprehending a single predator, $\Gamma'(0)$, producers give up on enforcement effort $m = 0$. Therefore, $V(1 - \epsilon) > 0$. *Q.E.D.*

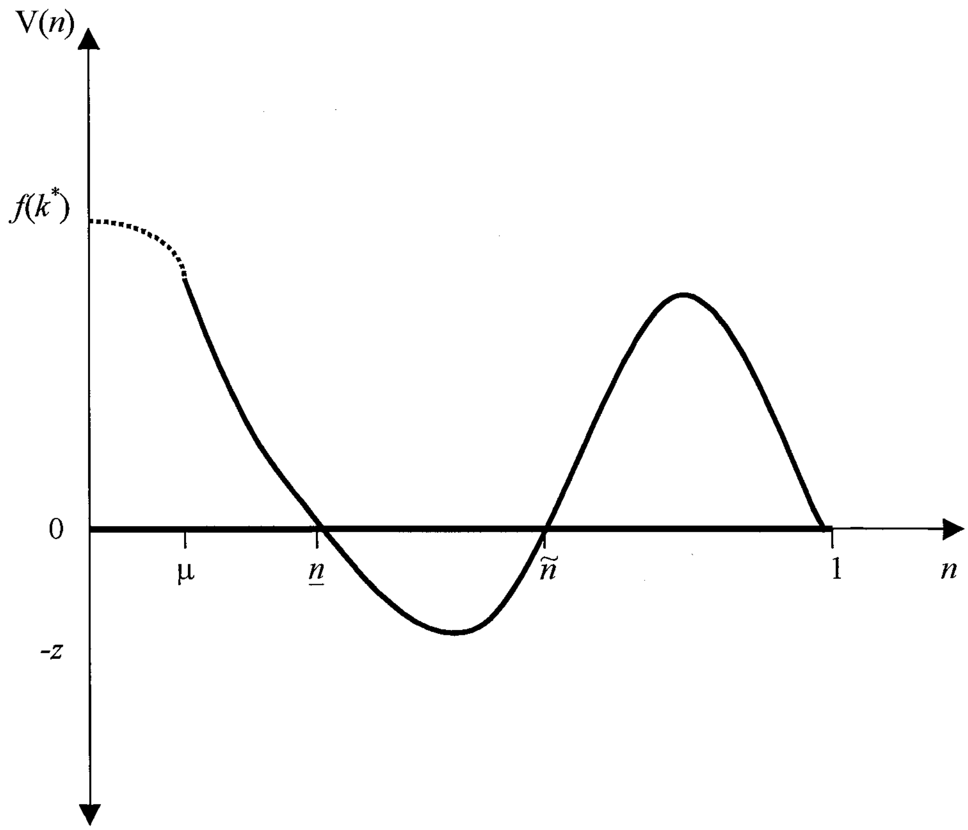
The intuition behind this lemma is as follows. As the number of expropriating predators tends to one, there is an equilibrium in which producers do not produce, fearing that all they invest will be taken from them with no efforts at enforcement undertaken. Given that producers do not invest resources in the production process, the returns from enforcement are insufficient to make any enforcement worthwhile. Notice that no restrictions on z are required for this proof. The severity of the punishment becomes irrelevant if no enforcement effort is undertaken.

Interior equilibria ($0 < \mu < n < 1$) may also exist. Having established that $V(0) > 0$, the continuity of V ensures an interior equilibrium if $V(n) < 0$ for some $0 < n < 1$. By picking a value of the punishment, z sufficiently high, one can always find an interior equilibrium. This leads us directly to Lemma 3:

Lemma 3 *For z sufficiently high, there exists at least one interior equilibrium, where* $V(n) = 0$ *for some* $0 < n < 1$.

It remains to show whether the model can display multiple equilibria, the case in which we are the most interested. The possibility of multiple equilibria, illustrated in Figure 2, is stated in the following proposition.

Figure 2: Multiple Equilibria in Expropriation



Proposition 1 *For some specifications of the model's functions and parameters, there exist multiple equilibria.*

Proof: The proof follows from Lemmas 2 and 3. If $V(1) > 0$, and if $V(n) < 0$ for some range of n, then by the continuity of $V(n)$ there must be two intersections between the expected return to expropriation curve ($V(n)$) and the expected return to predators who do not expropriate (equal to 0, the horizontal axis). *Q.E.D.*

Proposition 1 states that there can be multiple equilibria in expropriation, enforcement, and production. One corresponds to an equilibrium with high or even complete expropriation. A second is a low-expropriation equilibrium with $\underline{n}$ predators in the economy, where $\underline{n} < 1$. In this equilibrium, producers have a greater incentive for enforcement than in the high-expropriation equilibrium since the value of the production protected is higher (recall that $\frac{\partial \hat{k}}{\partial n} < 0$ and $\frac{\partial \hat{m}}{\partial k} > 0$).

There is a third equilibrium with a positive level of expropriation, enforcement, and production, where $V(n) = 0$. This equilibrium, however, is unstable. If an arbitrarily small but strictly positive measure of predators were to deviate from their equilibrium behavior, all others would deviate in the same direction until the economy arrived at one of the two stable equilibria of high or low expropriation.

The multiplicity of equilibria illustrates the important interconnection of legal infrastructure and production activity. Two economies, with identical technologies of production and enforcement, may arrive at entirely different outcomes. One may find itself prosperous with property rights that are well protected, while another may find itself too poor to make enforcement worthwhile, individually justifying the decision not to produce. A broader interpretation of this equilibrium is that the output of an economy suffering from expropriation will take the form of those objects least subject to expropriation. If the danger is thieves along the highway, the economy will produce only local goods; if the danger is bureaucratic shakedowns of organized economic activity in cities, people will turn to subsistence agriculture.

The key to the multiplicity of equilibria is that one's chances for getting away with expropriating behavior crucially depends on the number of others acting in the same way. In the low expropriation equilibrium, few will engage in expropriative behavior because such behavior, being isolated, can be easily caught and punished. If, however, all others are engaging in expropriation, one's chances of apprehension fall for any level of enforcement.

In some countries, the government itself may be the expropriator of the proceeds of market activity, thereby becoming a deterrent to economic activity. This can manifest itself in a number of interrelated ways. Poor property rights enforcement may then reflect not only the limited ability, but also the limited will of the government either to collect taxes or to allocate them for this purpose. Moreover, the absence of a transparent and merit-based career systems in government, low salaries, weak disciplinary systems, and poor accountability, all serve to lower the costs of engaging in expropriative activities, by reducing the likelihood of detection and punishment.[15] Predatory behavior by government officials can also raise the costs of enforcement, for example, by raising the cost of an effective audit when all others are acting in the same way. Good governance, by reducing the discretionary authority of the enforcers, and improving the effectiveness of enforcement effort can serve to reduce enforcement costs, thereby, increasing the incentive to make enforcement worthwhile.

C. Key Assumptions

Having presented the equilibria in this model, we can briefly discuss the assumptions underlying the model, and how changes in parameter values affect equilibrium outcomes. An important assumption for the existence of an equilibrium with much expropriation and little enforcement is the sequence of decisions: the enforcement decision is made after the predators' decision whether or not to expropriate. This sequence implies that in the high-expropriation equilibrium, predators will rationally anticipate that the producers will choose not to apprehend all the expropriating predators because the value of the exposed investment lies below the cost of enforcement.

One key to the existence of a high expropriation equilibrium is the assumption that the producers cannot ex ante commit to arrest law breakers. While a promise by producers to apprehend expropriating predators may well precede the predators' decisions, such a promise is not credible if the producers will not wish to apprehend ex post.

Another key to the multiplicity of equilibria is that each producer must choose its investment in the productive input independently of others – producers are unable to coerce or coordinate participation in the market economy. If, instead producers can jointly enforce on themselves a high level of investment, they can ensure that their investment will be worth protecting and in this way commit themselves to the enforcement of property rights. Recall that the incentive constraint on enforcement resulted from the reduction in the value of investment that occurs when each producer fears expropriation. No single producer can commit to investment worth the costs of enforcement because of the assumption that each single, infinitesimally small producer must expose its investment to a wide range of predators, so that the amount entrusted to each predator by any producer is insignificant.

[15] In this model, the punishment from engaging in expropriation is assumed to be exogenous. However, it is easy to imagine that punishments are likely to be mild when expropriation is systemic – it may be difficult to punish one person severely if the enforcers themselves are acting in a predatory manner.

Producers can, however, give themselves the incentive to capture a larger number of expropriating predators by coordinating their inputs to production.

III. EXTENSIONS

In this section we consider two extensions to our model: the possibility of development traps, and the decision to privately enforce property rights. Because the extensions complicate our model on other dimensions, let us consider an even simpler version of our basic model. Assume that $\mu = 0$ and that it costs γ goods to catch an expropriating predator, where γ is a positive constant, such that $\Gamma(m) = \gamma m$.

The production and expropriation decisions are essentially unchanged. The enforcement decision, however, now becomes an all or nothing decision. Producers collectively allocate the resources needed to apprehend every expropriating predator as long as the value of goods taken, $f(k)$, exceeds the constant marginal cost of enforcement, γ. Because all predators have taken the same number of goods, producers will choose to apprehend either all who expropriate or no one:

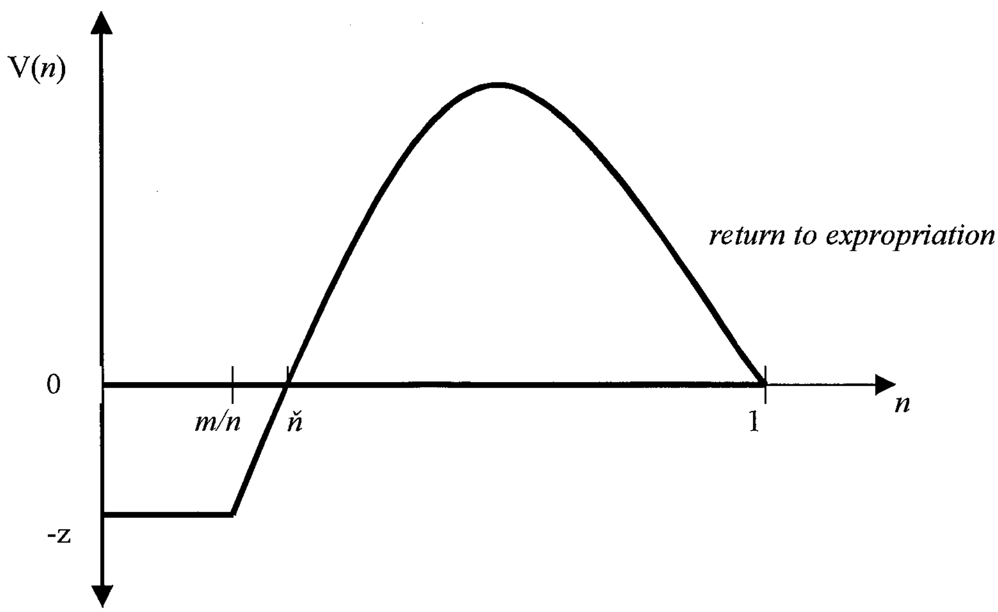
$$\begin{aligned} m &= 0 \text{ if } f(k) < \gamma \\ m &= n \text{ if } f(k) \geq \gamma \end{aligned} \tag{13}$$

Figure 3 shows the equilibrium return to expropriation for a predator as a function of n, for a given m and k. In this case we obtain two stable equilibria: one with no expropriation ($n = 0$), where production is undertaken until its marginal product equals the marginal rate of substitution ($f'(k) = u_h/u_c$). Let us label this level of input $\hat{k}$. Any single predator who chooses to expropriate can be caught. The other is an equilibrium with complete expropriation ($n = 1$), discussed earlier, where no enforcement or production is undertaken.

A. Private Enforcement Decisions

Enforcement is of necessity a collective operation in the models considered to this point. Because each infinitesimally small producer is exposed equally to a large number of predators, the output of a single producer in the hands of any single predator is infinitesimally small and, thus, less than the cost of catching an expropriating predator. For this reason, it is never worthwhile for a single producer to go after a predator who chooses to expropriate. Without collective action, predators will anticipate no enforcement and thus will always choose to expropriate. Therefore, if producers cannot choose enforcement collectively, the equilibrium with complete expropriation is the unique equilibrium.

Figure 3: Extensions to the Model: Boundary Solutions



A producer forced to discourage expropriation on its own can do so only if it can limit the number of predators with whom it must deal to a number consistent with an incentive to punish them. If, for example, we interpret predators as contractors supplying an essential but generic input to production, each producer will wish to contract with a single supplier of the input. With its entire investment in the hands of a single supplier, a producer acting on its own will have the incentive to enforce honest behavior on that supplier. If the supplier anticipates that the producer will have the incentive to enforce contracts, it will not expropriate.

It is important to note that there may be costs to reducing the variety of people with whom one deals. The services of predators may not be entirely interchangeable, so that a reduction in the producer's variety of contacts with predators may reduce its productivity. Let us therefore alter our model to allow producers a choice of the number of predators with whom they will deal. Assume that each producer is not infinitesimally small but that there are a large number of independent producers (each of measure one). Suppose there is a continuum of predators, measuring P in total. Each producer will select p, the measure of predators with whom it will deal. To make this choice nontrivial, let us assume that output per producer is a continuously differentiable function $F(k,p)$, increasing in both investment and the measure of predators with whom it deals. Each predator dealing with a producer controls an equal share of the producer's output; i.e., it can abscond with $F(k,p)/p$ goods. This amount is not divisible – the predator must take all of it or nothing. Let us assume for simplicity that a producer gets no utility from leisure ($u_h = 0$) so that it always invests its entire endowment of time ($k = y$). (This allows us to concentrate on the choice of p.) All enforcement is privately provided and can be targeted at any specific predator. It costs γ goods to catch an expropriating predator. Enforcement by a producer returns only those goods stolen from that producer. Given that enforcement is now to be independently financed, a predator will expropriate all of the output in its control from each producer who lacks the incentive to capture him.

A producer will want to capture a predator if the value of the investment in that predator's hands, $F(y,p)/p$ is not less than the cost of enforcement, γ. An equilibrium with no expropriation thus requires that $F(y,p) = p\gamma$. Since $F(y,p)$ is increasing in p, a producer will want the largest p meeting this incentive constraint. An interior equilibrium ($0 < p < P$) requires that $F(y,p) - p\gamma \geq 0$, and $F_p(y,p) - \gamma = 0$. These conditions implicitly define the equilibrium value of p as a function of desired investment, y, and the cost of enforcement, γ. It is easily verified that in equilibrium, p is an increasing function of y and a decreasing function of γ; i.e., where investment projects are small or enforcement costs are high (perhaps in less developed economies), producers will choose to interact with a minimal variety of predators, lowering the return to their investment.

B. The Trap of Underdevelopment

If an economy does not have the resources to invest enough to make enforcement worthwhile for any n (for example, if $f(y) < \gamma$), the only equilibrium is the one with complete expropriation. Low productivity, a low endowment, or high enforcement costs make this case more likely. In this case poor economies, those who start with low levels of productivity and endowments, may find it impossible to reach the low-expropriation equilibrium. Moreover, if growth in technology and endowments is endogenously determined by market activity, the poor economy may have no prospect of growing to the point where the low expropriation equilibrium is possible. In this way enforcement costs generate a threshold below which market activity does not develop, as in Azariadis and Drazen (1990). Unlike their model, this model does not assume an exogenous threshold in production. The threshold comes from the condition that enforcement is only credible if the value of market production exceeds the cost of enforcement.

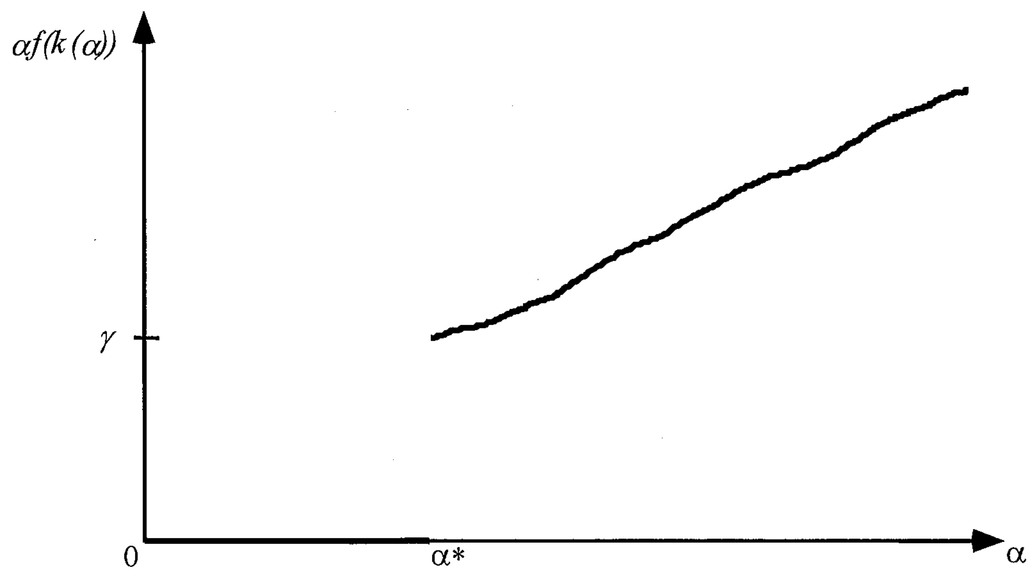
To illustrate the contribution of enforcement costs to the gap between rich and poor, consider a continuum of economies that differs continuously in α, a productivity parameter such that output equals $\alpha f(k)$. Let $k(\alpha)$ denote the input that would be chosen in an equilibrium without expropriation as a function of α. If consumption is a normal good, output, $\alpha f(k(\alpha))$, will be an increasing, continuous function of α. If $\alpha f(k(\alpha)) < \gamma$, the only equilibrium is the one with complete expropriation.

For simplicity, let us concentrate on the Panglossian case in which an economy will end up in a low expropriation equilibrium if there exists such an equilibrium. In this case, the equality $\alpha f(k(\alpha)) = \gamma$, implicitly defines some α^* below which $k = 0$ and above which $k = \hat{k}$. Figure 4 illustrates this cross section of equilibria by graphing output as a function of α. Similar cross sections would be found for economies differing in y or γ or in some preference parameter reflecting the desire to consume the market good.

Figure 4 dramatically illustrates the gap between rich and poor introduced by enforcement costs. Nations with only a marginal difference in technology around α^* find themselves producing greatly differing levels of output.

The model's implications for growth will depend on whether growth is endogenous or exogenous. Imagine a repeated version of this model in which the output from one period can be used as an input to production in the next period. If the productive technology grows exogenously (represented by a value of α that starts near zero but grows), an economy will languish for a while in the region of no output until α reaches α^*. At that point the economy will experience a dramatic takeoff in output. If, however, growth in the technology parameter requires economic activity, an economy that starts with a value

Figure 4: The Underdevelopment Trap: Cross Section of Equilibria



of α below $\alpha*$ will never reach the take-off threshold because the absence of market activity prevents an increase in technology.

IV. CONCLUSION

This paper presents a simple model of the interconnectedness of underdevelopment and expropriation. The two are intertwined in that when expropriation is widespread, market activity goes unrewarded and, without rewards, the market fails to produce the resources and, more importantly, the ex post incentives required to eliminate expropriation. As a result, we find underdeveloped economies unprotected from expropriation even though the degree of enforcement effort can be freely chosen.

The mutual importance of property rights enforcement and productive economic activity is most dramatically illustrated by the model's multiplicity of equilibria. Two identical economies can find themselves in widely different stable equilibria, one with a low level of expropriation and a high level of economic activity, and the other with widespread expropriation that discourages economic activity. The deterrence of expropriation is, however, not costlessly achieved in the low expropriation equilibrium. The expenditure on enforcement is higher in the low expropriation equilibrium because the higher return from production makes protection of property rights worthwhile. In the high expropriation equilibrium, however, the return from productive activity is too low to warrant enforcement.

In some countries, the government itself may seize the proceeds of economic activity, thereby, deterring economic activity and impeding the effective enforcement of property rights. The mutual importance of property rights enforcement and economic activity, therefore, suggests that reform of governance institutions, and economic reform should be pursued simultaneously. Without economic reform, the incentive to undertake legal reform and to enforce property rights may be weak. If, however, an economy does not have the resources to invest enough to make enforcement worthwhile, it may be unable to afford legal reform. Low productivity, a low endowment, or high enforcement costs make this case more likely. Economic reform, therefore, not only creates increased incentive for property rights enforcement, but also generates the resources necessary for the latter. At the same time, good governance structures can create the preconditions for sustained and broad-based economic growth.

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