Optimal Growth Policy Under Privately Enforced Property Rights

by

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OCTOBER 2004

Discussion Paper No.: 04-15
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October 20, 2004

Abstract

A model of growth and imperfect property rights is used to examine the impact that government fiscal policy can have in tempering the inefficiencies associated with insecure property. Looking at optimal fiscal policy in this context gives insight into the problems involved with imperfect property rights and points to the limitations that governments must face in dealing with these problems. The main lesson from the analysis is that pro-growth policies may well be undesirable in societies that lack the full rule of law. This is because growth breeds conflict over economic distribution, exacerbating the problem of diversion, and consequently, there are circumstances in which the benefit from faster growth is outweighed by the increased welfare cost of the accompanying diversion. The model features a causal relationship from institutional improvement to investment and growth; but more importantly, it indicates why the desirability of the development of institutions — nation building — may rest, not on the release of constraints on growth, but rather on the creation of a situation in which growth *per se* becomes desirable.

Keywords: optimal fiscal policy, growth, insecure property, conflict, diversion.

JEL classification: D74, E62, H21, O10, O40.

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1 Introduction

The critical importance for economic activity of a social structure of political and judicial institutions that provide a foundation for individuals in the enforcement of their property claims is widely recognized (e.g., Hall and Jones (1999) and Acemoglu et al. (2001)). Without such social institutions *homo economicus* will, in North’s phrase,${}^1$ maximize at every possible margin of activity, producing where profitable, but equally devoting resources to cheating, theft and plunder where profitable. In such a world rights to property must rely heavily on private enforcement. Productive investment and growth are harmed because economic agents do not receive the full benefit of their marginal product and because they devote otherwise productive resources to diversionary activity, both predatory and defensive.

Social control of diversion brings substantial economic benefits. However, the development of the necessary institutions — political system, courts, police, social attitudes, etc., nation-building in short — may require a considerable expenditure of time and resources, and a radical change in public attitudes and ideology. An important policy question is whether less fundamental instruments could help to ameliorate the problems that lack of social control implies. This paper analyzes the impact that government fiscal policy could have in tempering the inefficiencies associated with insecure property rights. We do not suggest that benevolent fiscal planners are a key part of economies that are characterized by conflict and ineffective property rights systems. Rather, looking at optimal fiscal policy in this context gives insight into the problems involved with incomplete property rights and points to the limitations that governments must face in dealing with these problems. The main lesson that can be drawn from the analysis is that pro-growth policies may well be undesirable in societies that lack the full rule of law.

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${}^1$See North (1987).
This outcome is superficially counter-intuitive. Both the negative effect of insecure property on the incentive to invest and the diversion of otherwise productive resources associated with conflict over economic distribution, when taken separately, suggest that pro-growth government policies are the appropriate ones. For example, conventional analyses that emphasize the importance of rent-seeking or imperfect property rights for growth have the common implication that increases in productive investment and growth and reductions in diversion must go together.\(^2\) However, this need not be the case, either in fact or in logic. Mokyr (2004, page 3) for example, emphasizes a natural complementarity between production and diversion that, although often recognized, is often left undeveloped in discussions of the role of property rights and growth:

*Throughout much of history, the wealth resulting from economic growth has tended to attract predators and parasites the way jam attracts houseflies: successful commercial and industrial regions raised the envy and greed of less fortunate or resourceful neighbors. Enterprise, industry, and ingenuity created opportunities for internal rent seekers who found politics or violence more remunerative than hard work. Regional commercial and financial success “invited” tax collectors, pirates, invaders, and default-prone borrowers . . . Economic growth indirectly helped instigate these conflicts.*

González (2004a) has explored this complementarity in a model of endogenous property rights and growth. Circumstances that would increase the marginal return on productive investment, leading to additional growth in equilibrium, will simultaneously lead to an increase in diversionary investments, as individuals allocate resources to maintain equality of their marginal returns.

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to productive and diversionary investment. This fundamental complementarity between productive and diversionary activities is the reason why second-best optimal policy may require that economic growth be limited in order to mitigate the problem of diversion.

The kind of growth model with imperfect property rights studied here is likely to be most relevant to the study of less developed economies, where the rule of law is not pervasive. Most recent theories of development and underdevelopment are well aware of the importance of imperfect institutions in explanations of the failure of economies to develop. Our paper contributes directly to this literature, but with a key difference in emphasis. The literature tends to see imperfect institutions as a constraint or barrier to growth, and if the constraints could be relaxed somewhat then further desirable growth could take place. The institutional constraints thus place a ceiling on growth, which is to be pushed against. This paper emphasizes the somewhat different idea that imperfect institutions, rather than placing a ceiling on growth, may make growth itself undesirable. The development of institutions — nation building — is not to release constraints on growth, but rather to create a situation in which growth \textit{per se} becomes desirable. This kind of idea is found in the work of Bates (2001), for example, who sees the fundamental problem of development as resulting from the fact that, absent institutions that guarantee property rights, prosperity breeds conflict or diversion; underdevelopment may then be chosen as a rational conflict-reducing solution in societies with insufficient protection of property — poverty is the price of peace. While Bates’ arguments are based on extensive observation and fieldwork, the present paper provides an explicit economic modeling of how such a result might emerge: growth with imperfect institutions brings with it a deadweight loss from self-protection that

\footnote{See, e.g., Robinson (1998), Parente and Prescott (1999), Hoff and Stiglitz (2001), Dixit (2003), Skaperdas (2003), Acemoglu et al. (2004) and the references listed in footnote 2.}
may be so burdensome that a benevolent government would choose to use fiscal instruments to reduce growth rather than increase it, to favor current consumption over wealth creation, in the interest of its citizens.

It is important to be clear on the normative role ascribed to government here. The literature on underdevelopment and insecure property rights often fingers government itself as one of the main predators on economic activity (e.g., North and Thomas (1973)). This important aspect of government is not considered here. Rather, first, property insecurity arises only from the covetousness of individuals in a situation where the state is either not willing or not powerful enough to support fully — with a police, court and punishment system — the defensive efforts of individual property holders. An extreme version of this abstraction is Hobbes’ state of nature, the “war of all against all”. A less abstract version is found in Bates’ discussion of stateless, but nonetheless highly structured societies, where property claims are mediated through complex clan and tribal systems. Similar issues also arise in the context of failed states such as Bosnia, Afghanistan, etc. Even in highly organized societies private enforcement of property rights is essential. The state does not replace private enforcement; rather it provides institutions that augment and magnify individual self-enforcement expenditures, which remain the basis for effective property rights (see, e.g., De Meza and Gould (1992), Grossman (2001)). This is a dimension also receiving increasing attention in the context of the East European transition to capitalism (e.g. Johnson et al. (1997), Roland and Verdier (2003)).

And second, government here is specified as a benevolent agent. In this framework Barro (1990) and Barro and Sala-i-Martin (1992) have discussed the potential for fiscal policy to generate Pareto-improving growth in the presence of production externalities and public goods.\(^4\)

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\(^4\)Well-known analyses of the influence of taxation on growth include Lucas (1990), Rebello (1991), Jones et al.
We contribute to this normative line of research by studying how imperfect property rights can influence optimal fiscal policy. Our analytical framework is a version of the endogenous growth model originally analyzed in Barro (1990), which emphasizes the provision and the public finance of productive public services that are complementary with private capital. We extend this framework to include a model of private enforcement of property rights. Here too we use a standard set-up, taken from the literature on rent-seeking and conflict over economic distribution (e.g., Hirshleifer (1991, 1995), Skaperdas (1992), Grossman and Kim (1995), Neary (1997), Esteban and Ray (1999), Grossman (2001), Baker (2003), González (2004b)). The analysis then highlights the interaction of two effects arising from externalities associated with imperfect property rights. First, there is an investment effect, because individuals do not internalize the fact that some of their own output accrues to others. Second, there is a conflict or diversion effect, because individuals do not internalize the fact that the social cost of productive investment in terms of consumption is too high, as growth breeds conflict. Consequently, to the extent that government policies are unable to remove the conflict effect, they ought to restrict growth in order to mitigate the problem of diversion. The main contribution of this paper is to show not only that second-best growth may be low relative to the first-best, but that it may also be low relative to the economy with no government intervention. In this sense anti-growth rather than pro-growth policies may be desirable in societies that lack the full rule of law.

Of course, a fully empowered planner would deal with the investment and the conflict effects by simply commanding agents to set diversionary investments to zero, and to set productive investments to the appropriate level. Likewise, with enough fiscal instruments and with perfect and costless enforcement of the government’s ability to tax and subsidize, the economy could be
brought arbitrarily close to the first-best outcome. In view of this our analysis concentrates on second-best optimal policies appropriate to situations where policy makers have access that is limited to specific fiscal instruments. Nonetheless we will consider policies that require a great deal with respect to the government’s ability to tax and subsidize: lump-sum taxes (equivalent here to consumption taxes), income taxes (equivalent here to output taxes), and a productive-investment tax. We introduce these taxes sequentially because they can be used to control the externalities separately, and this allows us to disentangle their individual impacts.

The plan of the paper is as follows. Section 2 presents the model to be analyzed. Section 3 characterizes a particular second-best planning problem that arises naturally in the presence of insecure property rights. Section 4 analyzes the solution to this constrained planning problem and shows how an income-tax system implements this second-best allocation. This second best is useful in allowing policy interpretations to be drawn. Section 5 considers the implementation of the first-best allocation. Section 6 provides some additional remarks on the results obtained.

2 The Model

Consider an economy with a unit measure of household-producers, each of whom seeks to maximize utility from his consumption stream, given by

$$U_i = \int_0^\infty e^{-\rho t} \log(c_i) dt,$$

(1)

with $\rho > 0$, where $c_i$ is agent $i$’s consumption. At each time $t$ individual $i$ produces output

$$k_i \psi(\cdot), \quad \text{where} \quad \psi \left( \frac{G}{k_i} \right) = A \left( \frac{G}{k_i} \right)^\alpha,$$

(2)
with $A > 0$ and $\alpha \in [0, 1)$, where $k_i$ is $i$’s capital stock, and $G$ is the stock of government-provided infrastructure capital.\footnote{The analysis to follow uses this Cobb-Douglas technology because it simplifies analysis and presentation. However the qualitative nature of the paper’s main results apply to balanced growth equilibria with a CES production technology given by $\psi(G/k) = A(\alpha(G/k)^{-\varsigma} + 1 - \alpha)^{-1/\varsigma}$, where $\varsigma \in [-1, \infty)$.} To focus attention on the externalities associated with weak property rights we assume that infrastructure capital is a non-rival and non-excludable public good.\footnote{See Arrow and Kurz (1970) and Barro (1990) for a discussion of alternative formulations of productive government activity.}

\section{2.1 Property Rights}

Output produced by an individual is insecure in that $i$’s claim to his own output can be contested by other individuals, and $i$ in turn may contest the claims of others to their production. For simplicity we model the possibilities here by imagining that individuals compete against the economy-wide average and that individual outputs are reallocated according to sharing rules that depend on how much each individual has invested in defending his own output and in seeking to appropriate output which is produced by others. Let $x_i$ be agent $i$’s stock of defensive capital — weapons, walls, ditches, secured storage etc. — and let $z$ be the average stock of offensive capital — weapons, driving or hauling capacity etc. Then the share of his own output that $i$ can hold onto is given by the function

$$p^i = \frac{\pi x_i^m}{\pi x_i^m + z^m},$$

where $m \in (0, 1]$ and $\pi \in [1, \infty)$; the parameters $\pi$ and $m$ are interpreted below. To complete the modeling of the property rights system we assume that individual $i$ claims a share of the
output of other individuals according to

\[ q^i = \frac{z_i^m}{\pi x^m + z_i^m} \]  (4)

where \( z_i \) is agent \( i \)'s stock of offensive capital and \( x \) is the average stock of defensive capital.

The gross income that is fully secured to an individual is given by

\[ y_i = p^i k_i \psi \left( \frac{G}{k_i} \right) + q^i k \psi \left( \frac{G}{k} \right), \]  (5)

where \( k \) is the average stock of productive capital. Net income in turn is allocated to current consumption \( c_i \), and to investment in the three capital stocks, \( k_i, x_i \) and \( z_i \). We assume for simplicity that the capital stocks, including infrastructure capital, are subject to the same depreciation rate \( \delta \in [0, 1] \). To ensure positive balanced growth for all \( m \in (0, 1] \) and \( \pi \in [1, \infty) \) we assume that \( A\alpha^\alpha \left( \frac{1-\alpha}{2} \right)^{1-\alpha} - \delta > \rho \).

We have chosen a model that is symmetric across agents in the interest of simplicity, and to highlight imperfect property rights and the interaction of the resulting externalities in abstraction from the particularities of a specific case. Our modeling of property rights allows a clear specification of the investment and diversion externalities that we are interested in analyzing, and it emphasizes some fundamental points about actual property rights, once we have abandoned the abstraction of ‘perfect’ property rights.\(^7\) Specifically, property rights are both costly and endogenously determined. The cost is borne by the agents, who must invest real resources in the project to secure their own property and to commandeer that of others. This

\(^7\)This form of sharing rule or ‘contest success function’ has been widely used in the rent-seeking literature (e.g., Dixit (1987), Rowley et al. (1988)) and in the conflict literature (e.g., Hirshleifer (1988, 1989), Skaperdas (1992), Grossman and Kim (1995), Esteban and Ray (1999), Grossman (2001)). Axiomatizations appropriate to these contexts can be found in Skaperdas (1996) and Clark and Riis (1998).
is inescapable in any society. The specification (3)–(4) allows both the defensive and predatory aspects of this project to be realized in a simple way.

The government’s role in ‘providing’ property rights is to provide resources — legal framework, police, court system, prison system — that leverage the defender’s defensive resources. This is a compact abstraction of how a property rights system actually works. The government provides support for the efforts of individuals to defend their property; the impact of this support is summarized by the value of the parameter \( \pi \), which we refer to as the ‘state of the law’ or ‘property rights’ parameter. This parameter introduces an asymmetry which gives a differentiated effect to defensive capital. For any capital stocks \( x_i \) and \( z \), the larger is \( \pi \) the larger is the share in output, \( p^i \), that the defender receives. At one extreme, when \( \pi \) is one there is no government support for the defender’s investment, no differentiated effect, and so the model gives equal access to both predator and defender. As the value of \( \pi \) rises access becomes differentiated, favoring the defender. Ceteris paribus, an increase in \( \pi \) allows the defender to reduce defensive capital and still maintain the previous claim on output; alternatively, holding defensive capital fixed makes it more costly for the predator to maintain the previous claim. The ideal of perfectness of property rights emerges as \( \pi \) approaches infinity. Then the defender receives a 100% share of his own output, irrespective of the values of offensive and defensive capital. Equilibrium in this limit will involve no externality since private defensive and offensive investments are irrelevant and approach zero. In a very natural way then the model allows property rights to be seen not as a dichotomy between perfect and imperfect, but as a continuum of imperfectness as \( \pi \) varies between 1 and infinity. In practical terms the state of the system will involve a higher or lower value of \( \pi \) with associated higher or lower values of diversionary capital. Effective property rights are the consequence of the interaction between \( \pi \) and the levels
of offensive and defensive capital.

The other key parameter of the specification in (3)–(4) is \( m \), the elasticity of the relative share of output \( \frac{\frac{p_i}{1-p'}}{\frac{p'}{1-p''}} = \pi \left( \frac{x_i}{z} \right)^m \) with respect to a change in the capital ratio \( x_i/z \). Along this dimension diversionary activities are assumed to be symmetric; \( m \) is also the elasticity of the relative share \( \frac{\frac{q_i}{1-q'}}{\frac{q'}{1-q''}} = \pi \left( \frac{z_i}{x} \right)^m \) with respect to a change in the ratio \( z_i/x \). It is a measure of the ‘effectiveness of conflict’ (see Hirshleifer (1989)). Assuming that \( m \leq 1 \) ensures that there are diminishing returns to diversionary activities throughout. The larger is \( m \) the greater is the impact on one’s relative share of output from an increase in one’s relative capital stock. The incentive to hold capital stocks for diversion is therefore larger the larger is \( m \).

2.2 Tax System

We are interested in the potential role and the limitations of government fiscal policy in mitigating the inefficiencies associated with insecure property rights. Accordingly, we assume that both private agents and the government take as given the property rights system specified above. A fully empowered planner could simply command agents to set diversionary investments to zero. Likewise, with enough fiscal instruments and with perfect and costless enforcement of the government’s ability to tax and subsidize, the economy could be brought to the first-best outcome. In view of this we suppose that the government cannot directly control or tax diversionary investment. The ability of the government to influence individuals’ incentives depends on the precise set of policy instruments available. We discuss the impact of alternative tax systems in Section 5, but our main findings will be illustrated under the assumption that the government has access only to an income tax. Agent \( i \)’s resource constraint is then

\[ y_i = c_i + I_i^k + I_i^x + I_i^z + T(y_i), \]  

(6)
where $y_i$ is given by (5) and the $I_i$'s are gross investment levels. As will become clear, we need consider only a linear income tax system consisting of a proportional income tax and a lump-sum tax

$$T(y_i) = \tau y_i + \ell.$$  \hspace{1cm} (7)

Finally, we assume that the government runs a balanced budget:

$$I^G = \int_1^0 T(y_i)\,di,$$  \hspace{1cm} (8)

where $I^G$ denotes gross infrastructure investment; that the government is a benevolent agent, seeking to maximize the sum of individual utilities; and that the government commits to all future infrastructure investment and taxes.

We restrict attention to symmetric equilibria. Agent $i$'s problem is to choose a sequence \{\(k, x, z, c\)\} which, given a sequence \{\(G, T\)\}, a sequence for the other agents \{\(k, x, z, c\)\}, and initial conditions \(k(0), x(0), z(0) > 0\), maximizes the agent’s utility (1) subject to the sequence of resources constraints (6). A symmetric private equilibrium is an allocation \{\(k, x, z, c\)\} that solves the problem of all agents simultaneously. A symmetric equilibrium is an allocation \{\(k, x, z, c\)\} and a government policy \{\(G, T\)\} such that (i) given the government policy, the allocation is a symmetric private equilibrium; (ii) given the allocation, the government policy satisfies the sequence of government budget constraints (8); (iii) the government policy maximizes \(\int_0^1 U_i\,di\), where \(U_i\) is given by (1).

2.3 The First Best

A useful benchmark is the first-best allocation that obtains when the state of the law parameter \(\pi\) is infinity, so there is a perfect and costless system of property rights. The first-best allocation
maximizes the representative agent’s utility subject to the economy’s resources constraint; lump-sum taxes are needed to finance infrastructure in the decentralized environment. Thus, the first-best allocation maximizes (1) subject to (6) and (8), with $T(y_i) = \ell$.

With lump-sum taxes the prices of infrastructure capital and private capital, in terms of consumption, are equal. Both types of capital are provided to the point that their marginal returns are equalized: therefore, the ratio of infrastructure capital to private capital, $g = G/k$, is given by the value $g^{fb}$ that solves

$$\psi(g^{fb}) - g^{fb}\psi'(g^{fb}) = \psi'(g^{fb}).$$

Note that $g^{fb}$ is determined by the elasticity of output with respect to infrastructure capital $(G/k)\psi'(\cdot)/\psi(\cdot)$. In the Cobb-Douglas case this elasticity is the constant $\alpha$ and

$$g^{fb} = \frac{\alpha}{1 - \alpha}.\tag{10}$$

In turn the growth rate of households’ consumption is constant and equal to

$$\gamma^{fb} = \psi(g^{fb}) - g^{fb}\psi'(g^{fb}) - \delta - \rho.\tag{11}$$

The appropriate lump-sum tax to finance first-best infrastructure investment is

$$\ell^{fb} = (\gamma^{fb} + \delta)g^{fb}k.\tag{12}$$

Finally, initial consumption is given by $[\psi(g^{fb}) - (1 + g^{fb})(\gamma^{fb} + \delta)]k(0)$, where the first term corresponds to initial income and the second term corresponds to the sum of initial gross investments in private and infrastructure capital.\(^8\) This can be expressed compactly as

$$c^{fb}(0) = \rho(1 + g^{fb})k(0).\tag{13}$$

\(^8\)For simplicity it is assumed that the economy starts on its balanced growth path.
With perfect property rights our model is similar to that of Barro (1990), except that he assumes $G$ to be a flow of public services that enters the production function; efficiency considerations then dictate that the marginal return to public services be set equal to their cost in terms of consumption, which is unity. However, the appropriate efficiency condition when both private and public investments enter production as stocks dictates that their rates of return be equalized, as in (9). In this case the marginal return to infrastructure capital is different from one in general, and is less than one in the Cobb-Douglas case, for all $\alpha \in (0,1)$.

3 Second-Best Optimal Allocations

In this section we characterize the allocation that solves the particular planning problem where the agents’ utility is maximized subject to the economy’s resources constraint and to a set of natural incentive-compatibility restrictions associated with imperfect property rights. To that end, we first discuss some key properties of symmetric private equilibria. Then we discuss the solution to the constrained planning problem. In the next section we show how this second-best optimal allocation can be implemented through an income tax system.

3.1 Properties of Symmetric Private equilibria

First we characterize key aspects of symmetric equilibrium allocations, which are interior, taking government policies as given. Standard manipulation of the first-order conditions for $i$’s problem indicates that the growth rate of $i$’s consumption must exceed the rate of time preference by an amount equal to the net return to investment activity,

$$\frac{\dot{c}_i}{c_i} = \left(1 - \frac{\partial T}{\partial y_i}\right) \frac{\partial y_i}{\partial k_i} - \delta - \rho,$$

(14)
where $\dot{c}_i$ denotes the time derivative of $c_i$. Further, individual $i$ optimizes by equating at the margin the impact on his income of each type of investment activity, whether productive or diversionary:

$$\frac{\partial y_i}{\partial k_i} = \frac{\partial y_i}{\partial x_i} = \frac{\partial y_i}{\partial z_i}. \quad (15)$$

This key principle is independent of the particular specification of property rights used. As will become clear (see equation (18)), what it implies within the current model is a simple set of equilibrium complementarities between the three investment activities. Thus, whereas current consumption and total investment are substitutes, investment activities are complementary to each other.

In a symmetric equilibrium, where $\{k_i, x_i, z_i\} = \{k, x, z\}$, for each $i$, the relationship between the capital stocks becomes particularly simple (see Appendix):

$$p^i = 1 - q^i = \frac{\pi}{\pi + 1} \equiv p(\pi), \quad (16)$$

$$\frac{x}{k} = \frac{z}{k} = \frac{m(1 - p(\pi))}{1 - \alpha} \equiv \phi. \quad (17)$$

That is, in symmetric equilibrium the security of property, $p(\pi)$, is determined solely by the property rights parameter $\pi$. In turn, $p(\pi)$ and $m$, together with the production parameter $\alpha$, determine the returns to appropriation relative to production. This is captured by $\phi$. The somewhat surprising result that $x = z$ relies upon the homogeneity and the symmetry of the conflict technology, the symmetry of the interior equilibrium, and the fact that $x$ and $z$ depreciate at the same rate. This ensures that the incentives to engage in the defense and the challenge of property claims respond symmetrically to changes in the parameters of the model and it greatly simplifies the details of the key complementarities. Similar complementarities, albeit more complex, can be expected in less symmetric scenarios.
Equations (16) and (17) show the impact of the two externalities associated with insecure property. In a symmetric equilibrium each individual receives a share $p(\pi) < 1$ of own output, which generates an investment externality. The quantitative impact of this externality in turn depends directly on the magnitude of $\pi$ which measures the degree to which society helps individuals protect their property claims by leveraging their defensive investments through a legal system. In equilibrium the share of output that each individual receives is independent of his diversionary capital stocks. A grand coalition that agreed to this share ex ante, with no diversionary expenditures, would make everyone better off since then the diversionary resources could be consumed or invested productively. However, given such an agreement, each individual playing non-cooperatively against the others would have an incentive to cheat and increase his share of output by building a predatory capital stock $z_i$. The share scheme $p(\pi)$ is self-enforcing only when individuals hold positive diversionary stocks. In turn this gives rise to a diversion externality. For every unit of productive capital held in equilibrium, $2\phi$ units of diversionary capital are held as well. Endogeneity of the defense of property rights thus acts as a “tax” on productive investment, effectively increasing its cost in terms of foregone consumption from 1 per unit to $1 + 2\phi$ per unit.

The magnitude of this diversion coefficient $\phi$ is larger the larger is the effectiveness of conflict, $m$, which increases diversionary incentives.\(^9\) It is larger the smaller is the equilibrium output share, $p(\pi)$, since the return to productive investment is lower in that case. The coefficient depends on the production technology through the ratio of the average to marginal product of private capital, which is determined in turn by the elasticity of output with respect to infras-

\(^9\)As $m$ goes to zero $\phi$ also goes to zero, eliminating the diversionary externality, but leaving the investment externality in place.
structure capital. In the Cobb-Douglas case the ratio is constant, $1/(1 - \alpha)$, and therefore $\phi$ is independent of $G/k_i$. The diversion coefficient $\phi$ falls as $(1 - \alpha)$ increases: the more important is $k$ relative to $G$ in production, the smaller will be the ratio of diversionary capital to productive capital. Finally, note that $\phi$ is independent of the parameters of the tax system, the marginal tax rate $\tau$ in particular. This tax rate therefore has no impact on the diversion externality.

3.2 Incentive-Compatible Optimal Allocations

To complete the solution to the private equilibrium requires a specification of the government’s taxation and infrastructure program. We could solve directly for the optimal tax rates and infrastructure levels subject to the first-order conditions of the private agents’ problems. However it is more convenient to work with a corresponding primal problem where a planner chooses allocations $\{I^G\}$ and $\{c_i, I^k_i\}$, for all $i$, to maximize the sum of utilities subject to an aggregate resources constraint, and subject to an incentive compatibility constraint imposed by the agents’ diversionary-investment behavior, which the planner cannot directly control. The constrained planning problem directly addresses the investment externality in that the planner, in choosing private productive-investment levels, takes into account the social marginal product of private capital $\psi(G/k) - g\psi'(G/k)$ rather than its private marginal product which is discounted by $p(\pi) < 1$. We characterize the solution to this planning problem now, and in the next section show how it can be implemented through a linear income tax system.

The planning problem allows for the fact that the private equilibrium is symmetric and therefore that the relationship between agent $i$’s diversionary capital and productive capital is given by equation (17). This relationship translates into an incentive compatible restriction on
agent $i$'s investment choices:\(^{10}\)
\[
I_i^x = I_i^z = \phi I_i^k.
\]  

(18)

Changes in the diversionary coefficient $\phi$ induce a tradeoff between productive and diversionary investment; but more importantly, (18) reflects the fundamental complementarity between the different investment activities. For a given opportunity cost of productive investment, as captured by $\phi$, increases in productive investment are accompanied by increases in diversionary investment. While the planner optimizes over $\{I^G\}$ and $\{c_i, I_i^k\}$, for all $i$, he is constrained by the fact that equilibrium diversionary investments will be made by the agents according to (18).

The aggregate resources constraint is
\[
\int_0^1 \left( y_i - (1 + 2\phi)I_i^k - c_i \right) di - I^G = 0.
\]  

(19)

Noting that the solution to the problem will be interior, the relevant Hamiltonian is
\[
H = \int_0^1 e^{-\rho t} \log(c_i) di + \int_0^1 \lambda_k (I_i^k - \delta k_i) di + \lambda_G (I^G - \delta G) \\
+ \lambda \left[ \int_0^1 \left( y_i - (1 + 2\phi)I_i^k - c_i \right) di - I^G \right].
\]  

(20)

The solution to this constrained planning problem is summarized as:\(^{11}\)

**Proposition 1.** There is a unique solution to the primal problem, which is characterized by

(i) the optimal ratio of infrastructure capital to private capital

\[
g^* = \frac{G^*}{k} = \frac{\alpha}{1 - \alpha} (1 + 2\phi);
\]

\(^{10}\)In general, when the elasticity of output with respect to $G$ is not constant, then $\phi$ can be altered by manipulating $G/k_i$. In that case $\dot{\phi} \neq 0$, where $\dot{\phi} \equiv (\partial \phi / \partial G)(I^G - \delta G) + (\partial \phi / \partial k_i)(I_i^k - \delta k_i)$. The incentive compatible restriction becomes $I_i^k = I_i^z = \phi I_i^k + k_i \dot{\phi}$, and the aggregate resources constraint is $\int_0^1 [y_i - (1 + 2\phi)I_i^k - 2k_i \dot{\phi} - c_i] di - I^G = 0$.

The arguments presented here under the Cobb-Douglas case, where $\dot{\phi} \equiv 0$, continue to apply to balanced growth equilibria under a CES technology.

\(^{11}\)See Appendix for details.
(ii) the common growth rate of $G$, $k$ and $c$

$$\gamma^* = \frac{\psi(g^*) - g^*\psi'(g^*)}{1 + 2\phi} - \delta - \rho;$$

(iii) the level of initial consumption

$$c^*(0) = \rho(1 + g^* + 2\phi)k(0);$$

_together with initial conditions $k(0)$ and $G(0) = g^*k(0)$. We analyze this solution in the next section and discuss its implementation through an income-tax system.

4 Optimal Fiscal Policy Under Insecure Property

4.1 Public Infrastructure and Private Capital

The main implication of the second-best optimal solution for the provision of infrastructure capital is given by

**Proposition 2.** The second-best optimal ratio of infrastructure capital to private capital, $g^*$, is inefficiently large; it rises with the effectiveness of conflict $m$; and it falls with the property rights parameter $\pi$.

The ratio of infrastructure capital to private capital given in Proposition 1 is determined by the natural optimality condition

$$\frac{\psi(g^*) - g^*\psi'(g^*)}{\psi'(g^*)} = 1 + 2\phi.$$  \hspace{1cm} (21)

This states that the marginal rate of substitution between government infrastructure and private capital is equated to their relative price, which is given by $1 + 2\phi$. In the perfect property rights
case this relative price is 1, so the respective marginal products of \( G \) and \( k \) are equalized. Comparing (9) and (21) it is evident that \( g^* > g^{fb} \); the planner, in a second-best solution constrained by the diversionary externality, chooses an inefficiently large stock of infrastructure relative to productive capital. The reason that infrastructure capital is inefficiently large, in first-best terms, relative to private capital, is contained in the previous discussion of the price ratio of the two capitals. To produce a given level of output the planner substitutes away from private capital to infrastructure capital because private capital induces \( 2\phi \) times its own stock of diversionary capital, while the latter induces none.

The model also suggests that, since the diversionary multiplier \( \phi \) is increasing in the effectiveness of conflict parameter \( m \) and decreasing in the security of property \( p(\pi) \), countries with stronger legal systems would have less distorted values of \( g^* \) than would countries with weaker legal systems. In this way relatively larger governments sectors and relatively weaker property rights systems are likely to be positively associated. The causality is not between larger, more predatory government and consequently weakened property rights however; quite to the contrary, relatively larger government is a second-best response to the problem of weak property rights. We do not advocate larger government in this sense as an unfailing positive remedy to property rights problems. However, it points to one avenue of response to weak property rights that involves indirectly reducing the capacity of agents to engage in diversionary investment.

The second-best crowding-out of private investment by government investment foreshadows a theme that will emerge more fully below. We have assumed a benevolent planner and malfeasant agents. Insofar as resources are being controlled by the planner then the agents have lessened opportunities to engage in bad behavior, as in this case where \( g^* \) is inefficiently high relative to the first best. While we do not allow the planner to control diversionary investments directly, an
investment subsidy together with a linear income tax system will enable the planner to crowd out diversionary investment, at the cost of having the planner effectively control all economic activity. We examine this issue in Section 5.

4.2 Growth

Now compare first-best and second-best optimal allocations. First, a comparison between the optimal growth rate $\gamma^*$ given in Proposition 1 and the first-best growth benchmark (11) indicates that the second-best allocation involves a growth rate that is less than the first-best solution. Intuitively, to obtain $\gamma^*$ the first-best growth rate must be adjusted to account for the fact that the social cost of private capital in terms of consumption is $1 + 2\phi$ rather than unity. The appropriate adjustment includes a reduction in the marginal product of private capital from its first-best level, as infrastructure capital is adjusted in order to crowd out private capital. The second-best growth rate is increasing with the productivity parameter $A$; it is decreasing with the diversion coefficient $\phi$, and so it rises with the property rights parameter $\pi$ and falls with the effectiveness of conflict $m$.

Second, a comparison between the optimal level of initial consumption $c^*(0)$ in Proposition 1 and the first-best level in (13) indicates that initial consumption $c^*(0)$ is too high, relative to the first-best level. This reflects both the direct impact of the diversionary externality ($2\phi > 0$), together with the induced effect of a relatively higher level of government infrastructure ($g^* > g^{fb}$). In the model current consumption comes from income to which effective property claims have already been established, whereas investment produces output that will be contested in the future. This imparts a ‘consume it or lose it’ bias in favor of current consumption. In the second-best solution initial consumption rises with $\pi$, falls with $m$ and it is unaffected by $A$. 
We summarize this discussion as

**Proposition 3.** The second-best optimal allocation features slower growth and a higher level of initial consumption than those associated with the first-best allocation. That is, $\gamma^* < \gamma^{fb}$, and $c^*(0) > c^{fb}(0)$. A fall in the diversion coefficient $\phi$ (due to an increase in the property rights parameter $\pi$, or to a decline in the effectiveness of conflict parameter $m$) causes $\gamma^*$ to rise and $c^*(0)$ to fall. An increase in the productivity parameter $A$ causes $\gamma^*$ to rise, but has no effect on $c^*(0)$.

Although it is not surprising that imperfect property rights are associated with inefficiently low growth and high current consumption, this comparison with the first-best is interesting for two reasons. First, the mechanism emphasized here works through the diversionary externality, rather than through the more familiar investment externality, which has been taken into account in the planning process. While the diversionary externality is widely recognized in the literature (see, e.g., Hall and Jones (1999)) it is less widely analyzed (see, e.g., Barro (1990), who looks at property rights in a model of government expenditure and taxation, but considers only the investment externality). And second, we are not describing a private economy with unameliorated property rights problems, but the problem of a planner who is explicitly optimizing the agents’ utility and can choose all quantities except the levels of diversionary investments. An economic advisor who knew the fundamentals of such an economy but ignored the effect of the diversionary externality would recommend growth at the rate $\gamma^{fb}$; this would be excessive in the presence of imperfect property rights.

Now consider the source of the comparative statics in Proposition 3. The reason why improvements in property rights lead to growth is not because a constraint on feasible growth is relaxed as the diversion multiplier $\phi$ falls (as $\pi$ rises or $m$ falls). Rather, as $\phi$ falls, faster growth
becomes desirable and the optimal growth rate rises towards the first-best value. Similarly, in the second-best solution the productivity parameter $A$ cannot be thought of as being no more than a simple determinant of feasible growth. While Proposition 1 indicates that the optimal growth rate $\gamma^*$ rises with $A$, it should also be noted that the difference between first-best and second-best growth rates,

$$\gamma^{fb} - \gamma^* = \psi'(g^{fb}) \left[ 1 - \left( \frac{1}{1 + 2\phi} \right)^{1-\alpha} \right],$$

is strictly increasing in $A$. This reflects the fact that there are feasible growth opportunities which would be optimal under perfect property rights, but not otherwise. Furthermore, note that the marginal increase in the difference $\gamma^{fb} - \gamma^*$ associated with higher $A$ is increasing with the diversion coefficient $\phi$, that is, $\frac{\partial^2 (\gamma^{fb} - \gamma^*)}{\partial A \partial \phi} > 0$, and is therefore increasing with $m$ and falling with $\pi$. These points illustrate a general idea underlying our analysis: the development of institutions does not promote growth by releasing constraints on it, but rather by creating a situation in which higher rates of growth become desirable.

### 4.3 Optimal Taxation

The second-best solutions described above can be implemented through a linear income tax system. Discussion of this possibility will lead us to the main implication of our analysis concerning the desirability of pro-growth government policies.

The primal problem in the previous section was not subject to all of the first-order conditions of the agents’ problems. In particular, it ignored the Euler equation (14) and the balanced budget restriction (8). A combination of a proportional income tax and a lump-sum tax can be used to ensure that these two constraints are satisfied in a decentralized equilibrium. First, (14) implies
that incentive compatible consumption growth must satisfy

\[
\dot{c} = (1 - \tau) p(\pi) \left( \psi(g^*) - g^* \psi'(g^*) \right) - \delta - \rho. \tag{23}
\]

It is immediate from a comparison between the expression for \(\gamma^*\) in Proposition 1 and (23) that the second-best solution can be implemented in the decentralized economy only if the marginal tax rate is set such that

\[
(1 - \tau^*) p(\pi) = \frac{1}{1 + 2\phi}. \tag{24}
\]

This time-independent marginal tax rate induces the agent to value capital at the margin at its appropriate second-best level. This tax takes into account both externalities: \(p(\pi)\) reflects the impact of the investment externality on the agent’s decentralized investment decision, while the \(2\phi\) term reflects the impact of the diversion externality, where it should be noted that \(\phi\) also depends on the value of \(p(\pi)\).

Second, the tax system also needs to achieve budget balance. The income tax collects instantaneous revenue \(\tau^* k \psi(g^*)\). This, combined with a lump-sum tax \(\ell^*\), must finance government expenditure \(I^G = G^*(\gamma^* + \delta) = g^* k (\psi'(g^*) - \rho)\) in each period. The lump-sum tax component therefore solves

\[
\ell^* = k \left( g^* (\psi'(g^*) - \rho) - \tau^* \psi(g^*) \right). \tag{25}
\]

**Proposition 4.** There exists a symmetric equilibrium that implements, through the income tax system \(T(y_i) = \tau^* y_i + \ell^*\), the second-best allocation characterized in Proposition 1. This equilibrium is Pareto superior in the class of symmetric equilibria and it has the property that \(\tau^* > 0\) if and only if \(p(\pi)m > \frac{1 - \alpha}{2}\).

Proposition 4 has strong implications concerning the desirability of pro-growth government policy. In particular, if \(\tau^* > 0\) then a growth-reducing, distortionary income tax is being called
for by optimal fiscal policy. For example the inequality $p(\pi)m > \frac{1-\alpha}{2}$ holds, when $m = 1$, for all values of the property rights parameter $\pi < \infty$, and for all values of the government share in production $\alpha \in [0,1)$. Consequently, when $m = 1$, optimal fiscal policy always prescribes a positive, distortionary income tax. In the special case where $\alpha = 0$ and, therefore, production exhibits constant returns in private capital alone, this implies that the second-best optimal rate of growth is lower than the growth rate in the pure no-tax-intervention economy, despite the fact that growth in the no-tax-intervention economy is already inefficiently low relative to the first best. The clear implication is that pro-growth policy is undesirable in these circumstances.

More generally, whether or not tax policy is pro-growth is defined here with respect to the no-tax economy, taking $g^*$ as given. We expect a subsidy aspect to $\tau$ in response to the investment externality, ceteris paribus. On the other hand, an income subsidy that raises growth also raises the levels of diversionary investment by $2\phi$. On this account, ceteris paribus, welfare would be increased by a tax on income rather than by a subsidy. The instrument $\tau$ thus has to deal with the two externalities simultaneously, and will be chosen to trade off the two conflicting impacts on welfare.

The larger is the effectiveness of conflict, $m$, the greater is the loss due to diversionary investment, and the more likely it is that a growth-reducing tax will be required in the second-best. The better is state of the law, higher $\pi$, and equivalently, the more secure are property rights, higher $p(\pi)$, the smaller are the losses from both investment and diversion externalities. Nonetheless, Proposition 4 indicates that, on balance, a higher value of $p(\pi)$ increases the likelihood that a tax on income is the optimal second-best policy. Finally, an increase in $\alpha$, the weight of infrastructure capital in production, increases the diversion coefficient. The higher this value is the more likely the marginal tax rate is to be positive, to counter diversionary investment by
reducing growth.

The possibilities are best illustrated by a figure. Figure 1 plots the optimal tax rate $\tau^*$ as a function of the security of property $p(\pi)$ for three different values of the effectiveness of conflict, $m = 0.5, 0.75, 1$. Panels 1, 3 and 5 on the left refer to an economy where government infrastructure plays no role in production (that is, where $\alpha = 0$). When $m$ is sufficiently small, as for example $m = 0.5$ in panel 1, optimal policy requires an income subsidy, because the investment externality is the main source of efficiency losses. As $m$ increases the investment externality continues to be the main source of efficiency losses as long as $p(\pi)$ is close to $1/2$. However, increasing $m$ increases the importance of the diversion externality, and an income tax becomes optimal for sufficiently high values of $p(\pi)$, as in panel 3. When $m = 1$ as in panel 5 the optimal tax rate is always positive. Panels 2, 4 and 6 on the right illustrate the same effects when $\alpha$ equals 0.3. Qualitatively these panels parallel those on the left; however it is clear that the effect of increasing the share of infrastructure in output is to increase the optimal tax rate at each value of $p(\pi)$.

[FIGURE 1]

If the effectiveness of conflict is sufficiently high ($m > 1/2$) optimal tax rates are hill-shaped with respect to the security of property $p(\pi)$, with positive tax rates for $p(\pi)$ sufficiently close to one. This indicates that income taxes are optimally used to limit increases in growth that are associated with increases in the property rights parameter $\pi$. For instance, starting from a situation where the optimal policy prescribes a zero tax rate, a marginal increase in $\pi$ is met by a tax increase. This response reflects the fact that the corresponding improvement in the security of property, $p(\pi)$, would lead to excessive growth in the no-tax economy since it breeds excessive conflict relative to the second best.
In fact, as shown in González (2004a), an increase in $\pi$ may even result in lower welfare in a no-tax economy (and where $\alpha = 0$). This perverse effect is eliminated from the second-best solution analyzed here because the optimal allocation is always adjusted to ensure that the growth rate is welfare maximizing. To see this more clearly, note that the level of initial consumption and the growth rate satisfy

$$c(0) = \left( \psi(g) - (1 + g + 2\phi)(\gamma + \delta) \right) k(0)$$

and

$$\gamma = (1 - \tau)p(\pi) \left( \psi(g) - g\psi'(g) \right) - \delta - \rho$$

in a decentralized economy with tax rate $\tau$ and with $g = G/k$. One can then ask how a change in the time-invariant tax rate $\tau$ would affect the agents’ utility, for any time-invariant value of $g$:

$$\frac{\partial U}{\partial \tau} = \left( \frac{\partial U}{\partial \gamma} \right) \frac{\partial \gamma}{\partial \tau} + \left( \frac{\partial U}{\partial c(0)} \right) \frac{\partial c(0)}{\partial \gamma} \frac{\partial \gamma}{\partial \tau}.$$  

(28)

It is easy to check that, at $\tau = \tau^*$ and $g = g^*$, the term in parentheses in the right side of (28) is zero. This implies that $\frac{\partial U}{\partial \gamma} = 0$; we can think of the growth rate at the second-best optimum as having been adjusted in such a way as to maximize welfare, taking account of the fact that growth breeds conflict. Further, the indicated term in (28) is zero if and only if $\psi(g) - (1 + g + 2\phi)(1 - \tau)p(\pi)(\psi(g) - g\psi'(g)) = 0$; this latter equality implies that the above expression for $c(0)$ reduces to that in Proposition 1, which is independent of the growth rate.

That the growth rate maximizes welfare and that initial consumption is independent of growth are equivalent statements.

Note that the marginal tax rate is independent of the level of infrastructure capital; this indicates that it is chosen to ameliorate externalities only, not to finance infrastructure.
Finally, even though fiscal policy optimizes social welfare (constrained by the agents’ diversion investments) this optimization does not imply that improvements in property rights must be welfare-enhancing; this observation further illustrates the complexity of the policy problem when property rights institutions function imperfectly. In particular, noting that \( \pi \) and \( m \) influence both initial consumption and the growth rate only through the coefficient \( \phi \), it can be verified that social welfare is increasing with \( \pi \) and declining with \( m \) if and only if

\[
\frac{\rho}{A\alpha^\alpha (1-\alpha)^{1-\alpha}} < 1 - \alpha. \tag{29}
\]

Our assumption ensuring positive growth also ensures that the denominator of the left side of this inequality is greater than \( \delta + \rho \). Accordingly, a sufficient condition for improvements in \( \pi \) or \( m \) to increase social welfare is that \( \rho < (\delta + \rho)(1 - \alpha) \). This is always the case when the share of infrastructure capital in production, \( \alpha \), or the discount rate \( \rho \), are sufficiently low. However, if \( \alpha \) is sufficiently close to one, then an increase in \( \pi \) or a decline in \( m \) will result in a welfare loss. When \( \alpha \) is sufficiently close to one the optimal ratio of infrastructure to private capital \( g^* \) and, accordingly, the growth rate \( \gamma^* \), are very responsive to changes in the social cost of private investment \( 1 + 2\phi \). Then a decline in \( \phi \) may generate a sufficiently high increase in growth and, consequently, a sufficiently high increase in diversion, that current consumption will fall to the point of lowering welfare.

Pro-growth government policy is the conventional prescription, and is supported by models that focus on the investment externality to the neglect of the diversionary one, and which see growth and prosperity as outcomes that will directly supplant diversion. The growth-reducing tax case is less conventional, and is the one that we wish to highlight here. It stems from the fact that in this model where property rights are endogenous, and must be purchased at a cost, the resulting diversion externality inevitably means that growth and prosperity directly induce
wasteful diversionary investment. If growth brings too much diversion then welfare may be increased by reducing growth rather than by increasing it. This is a second-best consequence, however unorthodox it may seem, of the fact of incomplete property rights and it formalizes what Bates (2001) describes as the key problem of development, that of achieving growth without inducing diversion and conflict.

5 Implementing the First-Best Allocation

Our discussion so far depends on the fact that the tax system to which the government has access was restricted by assumption. Specifically, while the investment externality was addressed by the income tax, no effective means of altering the diversionary coefficient was available.\textsuperscript{12}

However, it is useful to consider alternative scenarios where the first-best allocation can be implemented. In Section 2 the first-best allocation was implemented through a lump-sum tax under the assumption that the property rights system was perfect, that is, $\pi = \infty$. Alternatively, consider an imperfect system of property rights in the sense that the state of the law parameter is $\pi < \infty$, but suppose that conflict is infinitely costly, that is, suppose that $m = 0$. In this case, a subsidy on income at a constant rate would correct the investment externality and implement the first-best allocation; a lump-sum tax can then be levied in order to finance the income subsidy as well as public investment in infrastructure. Even when $\pi < \infty$ and $m > 0$, so that the conflict externality has nontrivial effects, the first-best allocation can be implemented if an unrestricted system of costless and well-functioning taxes is in place.

Though we assume that diversionary investments cannot be targeted directly, the effects

\textsuperscript{12}For a CES production function this coefficient could be manipulated through the value of the capital ratio $g$ but not in a way that would lead to the first-best outcome.
of a tax on appropriative activities can be replicated if all non-appropriative activities can be
taxed or subsidized. In particular, a subsidy to private productive investment will increase the
private marginal product of productive relative to diversionary capital. Productive investment
is encouraged relative to diversionary investment, ceteris paribus, effectively reducing the value
of the diversion coefficient. Thus the diversion externality can be manipulated directly by an
investment subsidy. The income tax system must also adjust. An investment subsidy that is
high enough to reduce the diversion coefficient towards zero, as required by the first-best, will
result in too high a level of growth and output unless a marginal income tax at a sufficiently
high rate is imposed to counter-act it. The lump-sum tax must then change to allow for budget
balance.

To see the effects of this redefine the tax system to include an investment tax at the constant
rate \( \tau_k \) on private productive investment. This is an arbitrary tax specification that may not
be locally optimal, but in combination with income taxes it allows achievement of the first best.
Budget balance for the government now requires

\[
\int_0^1 \left( \tau y_i + \tau_k I_i^k + \ell \right) di = I^G. \tag{30}
\]

The first-order conditions for agent \( i \)'s problem now imply that

\[
\frac{1}{1 + \tau_k} \frac{\partial y_i}{\partial k_i} = \frac{\partial y_i}{\partial x_i} = \frac{\partial y_i}{\partial z_i} = \frac{1}{1 - \tau} \left( \frac{\dot{c}_i}{c_i} + \delta + \rho \right). \tag{31}
\]

To account for this modification, the primal problem needs to be restated only to the extent
of replacing the diversion multiplier \( \phi \) with \( (1 + \tau_k)\phi \). Accordingly, the optimal allocation is
still found as in Proposition 1, simply replacing \( \phi \) with \( (1 + \tau_k)\phi \). It is immediate that, as \( \tau_k \)
approaches \(-1\), the optimal allocation \( (g^*, \gamma^*, c^*(0)) \) approaches \( (g^{fb}, \gamma^{fb}, c^{fb}(0)) \). The first best
can be approximated arbitrarily closely as the subsidy rate on productive investment approaches
100%. The marginal return to diversion is infinite at zero diversion in our model and so a total subsidy is required to eliminate all diversion. This full subsidy of private investment is not a palatable solution. It becomes even less so when the implied income taxes for a decentralized solution are considered. To equate the private return and the social return on productive investment the marginal income tax rate must satisfy

\[
\frac{1 - \tau}{1 + \tau_k} p(\pi) = 1
\]

requiring the marginal income tax rate to approach 100%. Under a 100% investment subsidy growth would be too high; a 100% income tax is needed to suppress this excessive growth. Finally, in the presence of a 100% income tax, first-best consumption will be fully subsidized by the lump-sum amount \( \ell = \rho(1 + g^{fb})k \).

This taxation solution to the imperfect property rights problem is not one that can be recommended seriously as a policy alternative. As noted above, with a benevolent government and misbehaving agents the externalities can be dealt with by crowding out the agents’ ability to invest in diversion. This is why the second-best infrastructure to private capital ratio, \( g^* \), is higher than in the first-best. This crowding-out role is now taken by the investment subsidy, which leaves the state of property rights unchanged at \( p(\pi) \) but avoids the externalities by controlling agents’ decisions to the exclusion of diversion investments. However when all output, consumption and productive investment are cycled through the government budget the result is a Soviet-like authoritarian system. As a practical matter it is likely to be even less capable of achieving the first-best than the actual Soviet system was: it requires a well-functioning tax system whose absence is conspicuous precisely in societies that suffer property insecurity and conflict over economic distribution; it requires an ideal government that is benevolent, provides productive services efficiently and can commit to future government spending and tax policies;
above all, counting on benevolence in a government that controls the quantities so completely would be naive.

Despite this the model presented here is of relevance in conceptualizing the manner in which collapsing authoritarian regimes may give rise to large-scale diversionary activity in their successor states. Yugoslavia, the Soviet Union, Afghanistan and Iraq are instances of this phenomenon. The problems associated with flawed property rights, weakness in the rule of law, emergent mafia behavior and disintegration into smaller political units in transition economies of the former Soviet Union has received considerable attention in the literature (e.g., Johnson et al. (1997), Roland (2000), Roland and Verdier (2003)); these problems have not yet been satisfactorily resolved. In terms of the present model, social order can be maintained in an authoritarian structure through extensive, exclusionary government decision-making. Despite the fact of order, the underlying state of the law parameter $\pi$ can remain completely undeveloped because it plays no role in the maintenance of order. In (32) for example, the magnitude of $p(\pi)$ is irrelevant; the first-best is achieved, not by providing the legal and political institutions that leverage the agents’ own defensive investments (i.e. pushing $p(\pi)$ to 1, as would be achieved by a ‘nation-building’ program), but by implicitly controlling quantities to the point where diversionary investment is crowded down to zero. However, once the authoritarian structure collapses self-enforcement of property rights at the low value of $\pi$ results in an immediate, dramatic readjustment of individual investments away from productive capital towards diversionary capital. The habit of order in the previous regime has no persistence in a decentralized successor regime in the face of low $\pi$. Just as the rapidity of the collapse of political order in the Soviet Union surprised most observers, so also the depth of disruption in the property system and the widespread lawlessness that followed decentralization of the old regime were a surprise
to many. The distinction between order through central control, and the failure of order under decentralized decision-making when legal support for individual property rights protection is absent, is useful in understanding this emergence of chaos.

Despite the conclusion drawn above that achieving a first-best allocation through the fiscal system is impractical, nonetheless the exercise demonstrates that there may be important welfare benefits associated with income taxes and investment subsidies in a world with imperfect property rights. Many societies have poorly developed income and investment taxes, collecting most revenue from sales taxes and excise taxes. Arguably, this is also a reflection of poorly developed institutions. In this regard, our analysis of income taxation and government spending indicates the potential benefits associated with responsible fiscal policy. Income taxes help mitigate the adverse effect of excessive growth when property rights are inadequate. Investment subsidies are in effect a differential tax against appropriative activities, which helps discourage the diversion of resources.

6 Concluding Remarks

The most important implication of our paper is that, in an economy characterized by imperfect and privately enforced property rights, growth may bring with it so much diversion that a second-best policy intervention would seek to reduce the rate of growth. The idea that growth may not be welfare improving in general is not controversial. Many analyses of the development problem begin with the observation that growth is not Pareto-improving because it has the potential to create both winners and losers. Whether growth occurs depends on the relative organizational abilities and political strengths of the competing interests. What these models suggest overall is that political transactions costs and institutional imperfections give rise to constraints that
impose a ceiling on growth; if growth could be engineered despite the vested interests this would be desirable. Institutional reform is aimed at removing barriers to growth.\textsuperscript{13}

Our paper, whose theme of imperfect property rights falls within the general transactions cost paradigm, is complementary to this literature, but differs in specifying the source of the problem and in pointing to remedies. We assume symmetry of the agents to abstract from distributional considerations that are not directly the focus of agents’ decision-making. Asymmetry of the benefits and costs of growth are not an issue; rather, the problem arises because the benefits of growth are contestable in the absence of the abstraction of ‘perfect’ property rights, and because the agents’ access to these benefits is endogenous to the investments they make in securing their own and others’ output. Symmetry means that either all benefit or all lose equally from growth. What is interesting and novel is that all can lose equally, because of the externalities they impose on each other through the self-provision of property rights. Institutional reform, here reflected in improvements in the state-of-law parameter, is intended not to remove barriers to achievement of desirable growth, but rather to make additional growth desirable by raising the second-best growth rate.

Weak institutions make growth beyond the second-best level undesirable and policy needs to account for this. In particular, circumstances in which an income tax would support the second-best are circumstances in which growth in the no-intervention equilibrium would be too high. Policy intervention in this status quo must seek to reduce growth to increase welfare. This case is not exceptional in the model. It is also not exceptional in the real world. For example, Bates (2001, page 47) concludes that, in the face a system of private and violent provision of

\textsuperscript{13}See e.g. Olson (1982), Mokyr (1990), Robinson (1998), Shleifer and Treisman (2002), Dixit (2003), Acemoglu et al. (2004).
security,

people may seek to increase their welfare by choosing to live in poverty ... egalitarianism becomes a strategy in which people forgo consumption for the sake of peaceful relations with neighbors. To forestall predation, they may simply choose to live without goods worth stealing. In such a setting, poverty becomes the price of peace.

Johnson et al. (1997) and La Porta et al. (1999) argue that, in the transition from socialism to capitalism, the evidence suggests that higher tax rates have been accompanied by reduced diversion. They argue that the causal link is from higher tax revenues to improved security of property rights (increased $\pi$ in our model). Our model exposes the possibility of other causal channels for such a relationship between taxes and diversion, even if institutions remain unimproved: higher taxes lower growth and so mitigate the problem of diversion; and higher taxes allow inefficiently high government expenditure that crowds out diversion.

Inequality is often seen a source of divisiveness and conflict in society and insofar as growth brings about inequality and conflict it may be undesirable. The development policy of institutions such as the World Bank is more nuanced now than in previous decades on the question of how aggressively growth ought to be pursued, and the syllogism of growth-inequality-conflict appears to be a component of this revision. Arguably, this dimension is an important consideration in the design of post-conflict development programs (see e.g. Obidegwu (2003)). In contrast, our model emphasizes the problems that arise even if the distribution of income is symmetric ex post, so long as it is manipulable ex ante. The agent has an incentive to invest in diversion because the non-cooperative expectation is that he will become better off at the expense of others. It is the potential for inequality, made possible by the imperfection and endogeneity of property rights, that results in diversion being a consequence of growth. Ex post inequality of course ex-
ists and intuition suggests it may worsen the problem of conflict. However, the analytical point is that, while a program of egalitarian income redistribution might reduce the aggregate level of diversionary investment, it would not erase the link between growth and conflict analyzed here. Imperfect property rights rather than inequality is the fundamental problem.

Finally, an important question that is raised by our analysis concerns the very definition of ‘good policy’. Our analysis suggests the natural possibility that second-best optimal policy and in particular second-best optimal growth is a function of the underlying institutions. To the extent that this is so, and there is a wedge between economic growth and social welfare, identifying policies that promote growth as being ‘good’ policies is misleading and potentially harmful. This brings a new element to the current debate on the role of institutions in economic development, which has focused on the extent to which institutions are the fundamental cause of growth (e.g., Acemoglu et al. (2004), Glaeser et al. (2004)). Our model does feature a causal relationship from improvement in property rights institutions to investment and growth. But more importantly, our analysis indicates that property rights improvement may be a necessary condition for increased investment, and increased growth *per se*, to be desirable, whether or not these increases are driven by broader institutional improvements or by other factors. We think that the practical relevance of recognizing the potential for efficiency gains from a revision of the view of what constitutes ‘good’ policy is apparent, for example, in the context of the current debate on foreign aid conditionality, where ex post growth is often assumed to be a clear indicator of good policy (e.g., Burnside and Dollar (2000)). Insofar as a trade-off exists between current consumption and growth because faster growth exacerbates the problem of diversion, then less growth may be the better policy because it can increase utility by reducing diversion and increasing current consumption.
Appendix

Properties of the Symmetric Private Equilibrium (derivation of (14)–(17))

The Hamiltonian associated with i’s problem is

\[ H_i = e^{-\rho t} \log(c_i) + \mu_k (I^k_i - \delta k_i) + \mu_x (I^x_i - \delta x_i) + \mu_z (I^z_i - \delta z_i) \]

\[ + \mu_i \left[ p^i k_i \psi \left( \frac{G}{k_i} \right) + q^i k \psi \left( \frac{G}{k} \right) - I^k_i - I^x_i - I^z_i - c_i - T(y_i) \right], \tag{33} \]

where we have disregarded the non-negativity constraints on the capital stocks, since they turn out not to be binding in equilibrium. The first-order conditions associated with \( H_i \) include

\[ \frac{\partial H_i}{\partial c_i} = \frac{\partial H_i}{\partial I^k_i} = \frac{\partial H_i}{\partial I^x_i} = \frac{\partial H_i}{\partial I^z_i} = 0, \tag{34} \]

which imply that \( \mu_k = \mu_x = \mu_z = \mu_i = e^{-\rho t} \frac{1}{c_i} \). Using this, the remaining first-order conditions include

\[ \frac{\partial H_i}{\partial x_i} = \frac{\partial H_i}{\partial z_i} = \frac{\partial H_i}{\partial k_i} = \mu_i \left( 1 - \frac{\partial T}{\partial y_i} \right) \frac{\partial y_i}{\partial k_i} - \mu_k \delta = -\dot{\mu}_k, \tag{35} \]

and

\[ \lim_{t \to \infty} e^{-\rho t} \frac{k_i}{c_i} = \lim_{t \to \infty} e^{-\rho t} \frac{x_i}{c_i} = \lim_{t \to \infty} e^{-\rho t} \frac{z_i}{c_i} = 0, \tag{36} \]

together with i’s resources constraint.

Equations (14)–(15) follow immediately. To derive (16)–(17), differentiate (5) to see that

\[ \frac{\partial y_i}{\partial x_i} = \frac{\partial y_i}{\partial z_i} \] implies

\[ \frac{x_i}{z_i} = \frac{p^i(1 - p^i)k_i \psi(G/k_i)}{q^i(1 - q^i)k \psi(G/k)}, \tag{37} \]

and \( \frac{\partial y_i}{\partial k_i} = \frac{\partial y_i}{\partial x_i} \) implies

\[ \frac{x_i}{k_i} = \frac{m(1 - p^i)\psi(G/k_i)}{\psi(G/k_i) - \frac{G}{k_i} \psi'(G/k_i)}. \tag{38} \]

In a symmetric equilibrium, \((k_i, x_i, z_i) = (k, x, z)\) for each \( i \). Thus, \( p^i = 1 - q^i \). Then (37) implies \( x = z \). It follows that \( p^i = p(\pi) \), as stated in (16). (17) follows from this, when evaluating (38) using the Cobb-Douglas form of \( \psi \).
Proof of Proposition 1

The first-order conditions associated with $H$ in (20) are

$$\frac{\partial H}{\partial c_j} = \frac{\partial H}{\partial I^c_j} = \frac{\partial H}{\partial I^G} = 0, \quad \forall j,$$

(39)

which imply that

$$e^{-\rho t} \frac{1}{c_j} = \lambda = \lambda_G = \frac{\lambda_{k_j}}{1 + 2\phi}, \quad \forall j,$$

(40)

together with

$$\frac{\partial H}{\partial G} = \lambda \int_0^1 \left( \frac{\partial y_i}{\partial G} \right) di - \delta\lambda_G = -\dot{\lambda}_G$$

(41)

$$\frac{\partial H}{\partial k_j} = \lambda \int_0^1 \left( \frac{\partial y_i}{\partial k_j} \right) di - \delta\lambda_{k_j} = -\dot{\lambda}_{k_j}, \quad \forall j,$$

(42)

$$\lim_{t \to \infty} e^{-\rho t} \frac{G}{c_j} = \lim_{t \to \infty} e^{-\rho t} \frac{k_j}{c_j} = 0, \quad \forall j,$$

(43)

together with the aggregate resources constraint (19). Using symmetry, noting that

$$\int_0^1 \left( \frac{\partial y_i}{\partial k_j} \right) di = \psi(g) - g\psi'(g),$$

(44)

(40)–(42) imply (21) and the solution for $\gamma^*$ given in Proposition 1. Simplifying (21) gives $g^*$, as stated in the proposition. To find $c^*(0)$, write the resources constraint (19) as

$$k\psi(g^*) = c(0)e^{-\gamma^*t} + (1 + 2\phi + g^*) \left( \dot{k} + \delta k \right).$$

(45)

The unique solution to this ordinary differential equation consistent with (43) is

$$k = \frac{c}{\psi(g^*) - (1 + 2\phi + g^*) (\gamma^* + \delta)}.$$

(46)

Using the solution $\gamma^*$, $c^*(0)$ in the proposition follows.

It is clear that the non-negativity constraints that were omitted would not be binding. It is also clear that $c^*(0) = [\psi(g^*) - (1 + 2\phi + g^*) (\gamma^* + \delta)] k$, $I^k = (\gamma^* + \delta) k$ and $I^G = (\gamma^* + \delta) g^* k$ is the unique symmetric solution to the system of first-order conditions. It remains to verify the
second-order conditions. From Proposition 8 in Arrow and Kurz (1970, ch. 2), it is sufficient to show that the Hamiltonian (20) evaluated at the optimum is concave in \((k, G)\). It is easy to verify that this is the case, by substituting the optimized values of \(c(0), I^k\) and \(I^G\) in (20). This concludes the proof.

Proof of Proposition 2

It follows from noting that \(g^* = g^{fb}(1 + 2\phi)\), where \(g^{fb} = \frac{\alpha}{1 - \alpha}\) and \(\phi = m (1 - p(\pi))\). \(\square\)

Proof of Proposition 3

To verify that \(\gamma^* < \gamma^{fb}\), compare the solution \(\gamma^*\), as given in Proposition 1, and (11), noting that \(\phi > 0\) and \(g^* > g^{fb}\), together with the fact that \(\psi\) is a concave function. To verify that \(c^*(0) > c^{fb}(0)\), compare \(c^*(0)\), as given in Proposition 1, and (13), noting that \(\phi > 0\) and \(g^* > g^{fb}\). The comparative statics with respect to \(\pi, m\) and \(A\) follow from taking derivatives in the expressions for \(\gamma^*\) and \(c^*(0)\). \(\square\)

Proof of Proposition 4

As explained in the main text, the allocation described in Proposition 1 can be implemented through the income tax system with the marginal rate given by (24) and the lump-sum tax given by (25). It follows that the allocation \\{\(c, k\)\} implied by Proposition 1, together with the allocation \\{\(x, z\)\} which satisfies (17), satisfies all the first-order conditions associated with \(i\)'s problem, taking as given that \(I^G = (\gamma^* + \delta)L^*k\) and that \(T(y_i) = \tau^*y_i + l^*\). The Hamiltonian associated with \(i\)'s agents problem, (33), evaluated at the optimum is concave in \((k, x, z)\), so the second-order conditions are also satisfied (Proposition 8 in Arrow and Kurz (1970, ch. 2)). Next, taking the agents’ implied decision rules for \(c, I^k_i, I^x_i\) and \(I^z_i\) as given, the policy \\{\(G, T\)\} characterized by \(I^G = (\gamma^* + \delta)L^*k\) and that \(T(y_i) = \tau^*y_i + l^*\) is an optimal policy, since it
implements the solution to the primal problem. Hence, the allocation \( \{c, k, x, z\} \) and the policy \( \{G, T\} \) just described form an equilibrium. Furthermore, it is the Pareto superior equilibrium among all symmetric equilibria since it implements the unique solution to the problem associated with (20). Finally, the necessary and sufficient condition for \( \tau^* > 0 \) stated in the proposition follows immediately from (24).
References


Figure 1: Optimal Income Tax Rates

Panel 1: $m = 0.5, \alpha = 0$

Panel 2: $m = 0.5, \alpha = 0.3$

Panel 3: $m = 0.75, \alpha = 0$

Panel 4: $m = 0.75, \alpha = 0.3$

Panel 5: $m = 1, \alpha = 0$

Panel 6: $m = 1, \alpha = 0.3$