

# Political Predation and Economic Development

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## Abstract

Economic growth occurs as resources are reallocated from the traditional sector to the modern sector, which is more productive. It is also more vulnerable to political predation, however. Political risk can therefore hinder development. We analyze a politico-economic game between citizens and governments, whose type (benevolent or predatory) is unknown to the citizens. In equilibrium, opportunistic governments mix between predation and restraint. As long as restraint is observed, political expectations improve and the economy grows. Once there is predation, the reputation of the current government is ruined and the economy collapses. If citizens are unable to overthrow this government, the collapse is durable. Otherwise, a new government is drawn and the economy can rebound. Equilibrium dynamics are characterized as a Markov chain. Consistent with stylized facts, equilibrium political and economic histories are random, unstable and exhibit long-term divergence. Our theoretical model also generates new empirical implications on the joint dynamics of income inequality, output and political variables.

# Political Predation and Economic Development

## 1. Introduction

Economic growth is often discontinuous (Easterly et al, 1993) and unpredictable (Hausman et al, 2002). Different economies have qualitatively different development paths, with phases of growth, stagnation and decline of varying length (Pritchett, 2000). The cross-section of countries exhibits divergence rather than convergence (Maddison, 1995, Pritchett, 2000, Allen, 2001). This paper offers a political-economic model where such growth paths can arise in equilibrium.

Our emphasis on the interaction between economic and political variables is motivated, in particular, by the experience of Sub-Saharan countries. The three cases of Botswana, Zimbabwe and Uganda offer a telling illustration:

- Figure 1, Panel A, depicts the evolution of real GDP per capita in Botswana from 1960 to 1999. In contrast with most other African nations, Botswana is democratic. Since independence, its government has behaved with restraint. Its presidents have famously been prudential rather than predatory (Harvey, 1985; Stedman, 1993; Acemoglu et al, 2003.) And in contrast to the economies of most other African nations, particularly those that are mineral rich, the economy of Botswana has steadily grown.
- As seen in Panel B of Figure 1, the economic history of Zimbabwe stands in contrast with that of Botswana. From 1979 – the year of independence – until 2000, real GDP per capita grew from USD 1,275 to 2,607. During this period, the president, Robert Mugabe, behaved with restraint and abided by the democratic constitution. In the year 2000, however, Mugabe embarked upon a policy of predation, seizing foreign exchange reserves from companies and banks and land from farmers. In three years, Zimbabwe GDP per capita fell by 30 percent.
- Lastly consider Panel C of Figure 1, which depicts economic growth in Uganda. Four years after independence, Idi Amin overthrew Milton Obote, Uganda's first president. In 1971, Idi Amin confiscated the properties of the Indian community. Such predation precipitated a collapse in the Ugandan economy. In 1979, Idi Amin lost power and in 1981 Museveni became president. He employed his power to promote production rather than to engage

in predation, and economic growth resumed (see e.g. Kasozi, 1994, Kabwegyere, 1995, and Khadiagala, 1995.)

Our theoretical model generates political and economic evolutions similar to those of Botswana, Zimbabwe and Uganda. It does so by analyzing the rational strategies of potentially predatory governments and the reaction of rational citizens.<sup>1</sup> In developing our argument, we make use of a variant of the standard model of a two sector economy (e.g., Lewis, 1954). Development results from the transfer of resources from the less productive sector, which we will call the informal or traditional sector, to the more productive, which we call the formal or modern. Citizens in the traditional sector are self-employed and work in household labor, or in artisanal production or farming. In the modern sector, production takes place in industrial or agricultural firms that utilize new technologies and physical capital on a relatively large scale.<sup>2</sup> Firms in the modern sector also rely on certification and information techniques, provided by financial intermediaries and accountants that enhance their ability to make use of sophisticated contracts (see Hicks, 1969). While these methods enhance their productivity, they also make firms more visible and more vulnerable to exactions by politicians. In contrast, informal activities are less visible, and it is more costly and less rewarding for the government to expropriate them (De Soto, 1989). This paper explores how the resultant differences in political predation risk alter the growth paths of economies.

To capture the impact of political risk, we introduce a government that may – or may not – be predatory. Benevolent governments never predate. In contrast, predatory governments extract rents from the modern sector by utilizing a well known range of instruments (e.g. Bates 1981, Lal 1983): altering the interest and exchange rates, regulating the structure of markets, raising prices in factor markets (for labor, for capital, and for services, such as electricity or transport) or altering the prices for the goods they sell to the benefit of customers. Alternatively, the government may demand payments from firms, i.e. engage in corruption; or it may seize their assets, i.e. nationalize firms and industries.<sup>3</sup>

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<sup>1</sup>Acemoglu and Zilibotti (1997) offer an interesting alternative rationalization for random growth path, emphasizing production risk, indivisibilities and lack of diversification.

<sup>2</sup>Note however that our model does not explicitly rely on economies of scale, and thus differs from another important class of two-sector models of development, starting with Rosenstein Rodan (1943); Murphy, Shleifer and Vishny (1989 a and b) have more recently developed this line of research, emphasizing economies of scale and market size.

<sup>3</sup>When mentioning the predatory government we refer to the political leaders, as well as the

To explore the impact of political choices, we consider a discrete time, infinite horizon model. Initially, nature draws the type of the government: benevolent or opportunistic. Then, at each period, citizens choose whether to operate in the informal or formal sector. The citizens are not perfectly informed about the government's type. Using past observations, they rationally update their beliefs about the likelihood of predation. As citizens lower their assessment of political risk, they become more willing to enter the more productive but more vulnerable modern sector.

In each period, the government, if opportunistic, decides whether or not to predate. In an environment of asymmetric information, the government's choice provides a signal of its type.<sup>4</sup> While predation generates immediate resources for the opportunistic government, restraint enhances political optimism, encouraging citizens to enter the formal sector. An opportunistic government, rationally anticipating the response of the citizens, trades off the immediate costs of restraint against the benefits of future predation. Its strategy takes the form of mixing between predation and restraint. The a priori distribution of the government's type and of its policy choices determine the citizens' assessment of political risk.<sup>5</sup>

As long as the government does not predate, political optimism increases; as resources flow to the modern sector, the economy grows. Citizens, however, rationally anticipate predatory governments to mimic the behavior of benevolent ones. They are therefore not certain whether the history of restraint reveals the presence of a benevolent government or merely reflects the efforts of a predatory one to "fatten" the modern sector before engaging in predation. The corresponding political risk lowers the growth rate. It also shapes the distribution of income. Because wages in the modern sector can be expropriated, they include a risk premium. There is therefore a wedge between the compensation promised in the modern sector and that obtained in the traditional. The risk premium, which is decreasing in the political reputation of the government, lowers the profits of the modern sector firms.

While we consider an infinite horizon model, we show there is an endogenous horizon to the politico-economic game played by the citizens and the government.

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elite closely associated to them.

<sup>4</sup>Our analysis is in line with the reputation models of Kreps and Wilson (1982) and Milgrom and Roberts (1982).

<sup>5</sup>Thus policy risk arises endogenously, reflecting the strategies of political and economic agents. This differs from exogenous random policy reversals or changes in the government (Alesina and Tabellini, 1989, Rodrik, 1991).

After a sufficiently long period of restraint, the probability that the government is benevolent becomes quite high. Citizens then allocate such a large portion of their resources to the modern sector that the government, if predatory, cannot resist the temptation to predate immediately.

The model yields a variety of growth paths. If the government is benevolent, the economy reaches full development at the endogenous horizon of the game. If the government is opportunistic, it will predate, in equilibrium, at some point between the beginning of the game and the time of this horizon. When citizens observe predation, they infer that the current government is predatory and the economy collapses. But citizens can try to resist predation and to overthrow the predator. If they are successful, a new government comes in power and the economy can rebound and start a new potential development path. If the government successfully resists the citizens' challenge, political confidence is lost, and the economic collapse lasts as long as the government remains in power.

The equilibrium dynamics of the politico-economic system are characterized by a Markov chain. We solve for its transition matrix and ergodic distribution. Both the extreme states – where the type of the current government is known – and the interior states – where the citizens are gradually learning about the government's type – have positive probability in the ergodic distribution. Correspondingly, persistent divergences arise, even among economies characterized by the same initial parameters. Thus the dynamics of our model recreate the patterns of “hills” and “mountains” observed by Pritchett (2000). Pritchett (2000) suggests one should: “examine the economic, political, institutional and policy conditions that accompany ... break points” in growth paths. Our model offers a theoretical framework for such an examination, and yields implications for the relationships between economic and political variables around these break points. Our theoretical analysis also generates dynamics that are in line with the empirical findings of Glaeser, La Porta, Lopez de Silanes and Shleifer (2004). In our equilibrium as well as in their empirical results, poor countries get out of poverty when dictators follow good policies and along this process institutions improve.

The next section reviews the literature. Section 3 presents our model. Section 4 presents the politico-economic histories arising in equilibrium. Section 5 discusses the robustness of our analysis. Section 6 outlines its empirical implications. Section 7 offers some concluding comments. The proofs are in the appendix.

## 2. Literature

Our paper complements the institutionalist theories of development. The origins of this literature lie in the work of economic historians. One variant addresses the economic rise of Europe (e.g., North and Weingast, 1989, and Root, 1989) and holds that institutional innovations – the creation of parliaments or central banks, for example – imposed constraints on political executives, thus limiting their ability to convert power into wealth through predation. Another comes from the economic history of the New World (Engerman and Sokoloff, 1997, and Acemoglu et al, 2001, 2002, 2004.) In countries that adopted good institutions early, this literature contends, economic development took place, while in countries that failed to do so, economic development did not occur or was long delayed.

We propose to enrich this picture by incorporating different government types and citizens' beliefs. Taking this approach, we show that countries with similar institutions can have different economic histories. In the standard institutionalist argument, political institutions are held to provide assurances to economic agents; given the incentives fostered by such institutions, predation lies off the equilibrium path. We too include institutions of restraint in our model, albeit in a simplified way. But in spite of these institutions, predation can take place on the equilibrium path. And, in spite of the risk of predation, economic agents can behave in ways that generate some growth. More surprisingly, stronger institutions do not necessarily make predation less likely. In our model, the strength of the resistance to predation depends on the strength of institutions and of the size of the population expropriated. The stronger the institutions, the greater the ability of the people to fend off predation. Thus, strong institutions may not succeed in deterring predation. To the contrary, they can encourage opportunistic governments to predate early, before the civil society has become sufficiently strong to overthrow them.

Our analysis is also related to the insightful analysis of Besley (1997). In both papers the government can be predatory; fearing the prospects of predation, economic agents refrain from entering the more productive sector; and after predation, they exit. The two papers also exhibit important differences, however. In Besley (1997), there are no informational asymmetries about the type of the government and predation does not occur on the equilibrium path.<sup>6</sup> In contrast, in our model, a positive probability of predation remains along the no-predation

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<sup>6</sup>Besley (1997) calls for extensions of his analysis incorporating imperfect information and political uncertainty. Our paper takes a step in that direction.

path. And because the equilibrium path is stochastic, our model generates a variety of possible growth paths and long term divergence in GDP per capita.<sup>7</sup>

Our model also complements an interesting body of research analyzing the case where there is asymmetric information about the type of the government, see e.g., Rodrik (1989), Perotti (1995) and Cheriau and Perotti (2001), which itself is in line with the seminal models of reputation by Kreps and Wilson (1982) and Milgrom and Roberts (1982). Our focus and analysis are different from theirs, however. Rodrik (1989) focuses on policy reversals and shows that good governments signal their types by implementing larger reforms than in the first best. Perotti (1995) shows how the benevolent government breeds confidence by following a gradual privatization policy and underpricing the shares. Cheriau and Perotti (2001) study option pricing when tax prone governments seek to attract investors by temporarily refraining from high taxes. Our analysis complements these articles by focusing on different issues – such as the transition from the traditional to the modern sector, political instability and long-term divergence – and by explicitly characterizing the equilibrium dynamics of the politico-economic system, both in terms of short-term transitions and in terms of long term distribution. A contemporaneous paper (Phelan, 2004) studies financial and monetary crises in a reputation model. Our work differs from his because of our focus on growth and development, and also because we make different assumptions. Phelan (2004) assumes there are unobservable changes in government type; we do not. We study wages, inequality and resistance to predation, while he does not.

### **3. A simple model of economic development and political risk**

#### **3.1. Citizens and governments**

We consider a discrete time, infinite horizon model where time  $t$  goes from 1 to infinity. The actors in our model – each rational and risk neutral – include a unit mass continuum of private citizens and an agent that possesses the power to engage in predation. The potential predator can be the current government, or another political player, who might attempt to seize power and expropriate other people's wealth. For simplicity, we hereafter refer to the potential predator as the government. Prior to the game, nature selects the government's type. With

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<sup>7</sup>In Section 5, we present an extension of our analysis encompassing the two types of equilibria arising in Besley (1997) and in our basic model.



probability  $\pi_0$ , the government is relatively benevolent. With the complementary probability  $(1 - \pi_0)$ , it is opportunistic.

For simplicity we first assume that the benevolent government always entirely refrains from predation, while the opportunistic government must choose between full restraint and full predation. While providing an oversimplified view of political choices, this assumption lets us to focus on the important problem of political risk. In Section 5, we consider a slightly less stylized model. There we assume that the benevolent government extracts some resources from the private sector. In that context, the opportunistic government must choose between such limited extraction and full predation. We show that our qualitative results still obtain in that setting.

### 3.2. The modern sector and the traditional sector

In line with Lewis (1954) and others (e.g., Harris and Todaro, 1970), we consider a two-sector economy. The traditional sector is less productive than the modern (which we also term the formal) sector of the economy. Because they benefit from access to superior technologies and better infrastructure, firms operating in the modern sector are more productive. Economic development occurs as resources move from the traditional sector to the modern.

Denote by  $\beta_t$  the fraction of agents operating in the modern sector at time  $t$ , and by  $1 - \beta_t$  the fraction of agents operating in the traditional sector. For simplicity, we set output in the traditional sector to  $1 - \beta_t$ , i.e., the marginal product in the traditional sector is constant and normalized to one. Output in the modern sector is:  $Y(\beta_t)$ . The production function  $Y(\cdot)$  is continuous, increasing and concave. Again for simplicity, we consider only one input: labor. We assume the modern sector is more productive than the traditional sector, i.e.,  $Y'(\beta) \geq 1, \forall \beta \in [0, 1]$ . Efficiency therefore requires that all the population work in the modern sector. To simplify the analysis we also impose some regularity conditions:  $Y$  satisfies the Inada condition that  $\lim_{\beta \rightarrow 0} Y'(\beta) = \infty$ . We also assume that:  $Y'(1) = 1$ , which implies that, when all agents work in the modern sector, the marginal productivity is equalized in the two sectors. As will be seen below, this assumption will also imply that, with positive levels of political risk, the optimal value of  $\beta$  remains strictly lower than 1.

A tractable parametrization for the production function is:  $Y(\beta_t) = k(\beta_t)^\alpha$ , which corresponds to the standard Cobb Douglas function:  $Y(\beta_t) = AK^{1-\alpha}\beta_t^\alpha$ , specialized to the case where capital is constant. For that function, the condition

that  $\lim_{\beta \rightarrow 0} Y'(\beta) = \infty$  holds. The assumption that  $Y'(1) = 1$  implies that  $\alpha k = 1$  and the assumption that the production function is increasing and concave implies:  $\alpha \in [0, 1]$ . In the analysis below, we will make use of this specification to illustrate our argument.

### 3.3. The first best benchmark

The first best allocation is the solution of:

$$\text{Max}_{\beta_t \in [0,1]} Y(\beta_t) + (1 - \beta_t).$$

Concavity of the production function implies that the second order condition holds. Under our assumption that  $Y'(1) = 1$ , the optimum is pinned down by the first order condition:  $Y'(\beta) = 1$ , and  $\beta = 1$ .

When there is no risk of predation, the competitive equilibrium implements the first best allocation in a decentralized way. Citizens working in the traditional sector obtain their marginal productivity, equal to one. They can be thought of as self-employed in the informal sector. Citizens employed in the modern sector receive the wage:  $w$ . As long as  $\beta < 1$ , equilibrium requires that workers be indifferent between taking a job in the modern sector and being self-employed in the traditional sector, implying that  $w = 1$ .<sup>8</sup> The modern sector firms are competitive and maximize profits taking wages as given. Their program is:

$$\text{Max}_{\beta_t \in [0,1]} Y(\beta_t) - \beta_t w.$$

Substituting in this program the equilibrium wage, the objective becomes:  $Y(\beta_t) - \beta_t$ , and the optimality condition yields the first best allocation. With political risk, however, equilibrium allocations can differ from the first best, as shown below.

### 3.4. The risk of political predation

The greater efficiency of the formal sector comes at the cost of greater political risk. Whether because the firms are larger, less mobile, or more visible, an opportunistic government finds it not only more lucrative but also less costly to prey upon output from the formal sector. To capture this vulnerability in the simplest possible way, we initially assume that, when the government chooses to predate at time  $t$ , it endeavors to capture the output of the modern sector:  $Y(\beta_t)$ . If it is successful, the

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<sup>8</sup>This indifference condition is sufficient but not necessary when  $\beta = 1$ .

profits of private firms are entirely expropriated and wages in the modern sector are not paid. In contrast, we assume that output in the traditional sector is protected from political predation. Thus, the risk of political predation can deter citizens from leaving the safe traditional sector, to enter the more productive modern sector.

At the beginning of each period, citizens make the initial move, choosing whether to work in the traditional or modern sector. The predatory agent then chooses opportunistically whether to seize the output of the latter sector or to refrain from predation. The strategy of the opportunistic government is therefore described by the probability that it refrains from predation at time  $t$ , denoted by  $\mu_t$ . If the opportunistic government never predated at time  $t$ , then  $\mu_t = 1$ . If it always engages in predation,  $\mu_t = 0$ . The intermediary case ( $0 < \mu_t < 1$ ) corresponds to a mixed strategy. Figure 2 portrays the sequence of play.

While citizens are initially uncertain about the government's type, they rationally update their prior expectations after observing its behavior. Because their actions play the role of a signal, predatory agents possess an incentive to pool with inoffensive ones, initially refraining from predation so as to enhance their reputation and subsequently secure a larger gain.

### 3.5. Political instability

When comparing gains during one period and during the next period, the potential predator discounts the latter at rate  $\delta_G (< 1)$ . While  $\delta_G$  can be interpreted as a standard discount rate, it can also be interpreted as the probability that the government will still be in office in the following period. In that interpretation, with probability  $1 - \delta_G$  there is an exogenous political shock, such as, e.g., an invasion or the death of the political leader. In that case a new government is in charge at time  $t + 1$ , with initial reputation:  $\pi_0$ .<sup>9</sup> As far as the mathematical analysis of the government policy is concerned the two interpretations – one in terms of discount rate and the other in terms of exogenous political shock – are equivalent.

We allow for the possibility that the government could be overthrown when it is

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<sup>9</sup>Mozambique offers an example (see Jones and Olken, 2004). Its historical leader, Samora Machel, was a predatory autocrat. Consistent with our theory, under his leadership Mozambique had very low gdp per capita. In 1986, Samora Machel died, which can be interpreted as an exogenous shock, as in our model. Joaquim Chissanao became the new national leader, which can be interpreted as a new draw, as in our model. Consistent with our model, as this new leader did not follow predatory policies, gradual growth obtained.

found to be predatory. Thus, we assume that, when the government predated, with probability  $\nu$  it is overthrown, while with probability  $1 - \nu$  it is not overthrown and retains its ill got gains. When the predator is overthrown, a new government comes in power (with initial reputation  $\pi_0$ ), the modern sector is not expropriated, and wages are paid. In contrast, when the government successfully predated and stays in power, modern firms are expropriated and modern sector wages are not paid.

It is natural to assume that resistance to predation is increasing in the number of people who are expropriated, i.e., in the fraction of the population employed in the modern sector,  $\beta_t$ . Hence, we assume that  $\nu$  is a continuous and increasing function of  $\beta_t$ . Accordingly, we denote it by  $\nu(\beta_t)$ . By analogy with the production function, the following expression provides a simple parametrization of the probability that the government is overthrown when it predated:

$$\nu(\beta_t) = \gamma\beta_t^\eta.$$

where  $\gamma$  and  $\eta$  are constants in  $[0, 1]$ , measuring the effectiveness of resistance to predation. When  $\gamma = 0$ , the government can safely predate, without any risk of being overthrown. When,  $\gamma = 1$  and  $\beta_t = 1$ , then the government is always overthrown when it predated.

Strong institutions enable civil society to better resist predation. Formal and informal checks and balances, a free and powerful press, a democratic culture and independent courts enhance the ability of the people to fight predatory governments. Thus, in our model, larger values of  $\gamma$  reflect stronger institutions.

#### 4. Equilibrium Politico–Economic Histories

The joint evolution of predation and entry in the formal sector arises as the equilibrium outcome of a dynamic game. At each point in time,  $t$ , the private sector and the government choose their optimal actions:  $\mu_t$  and  $\beta_t$ . Denote by  $\pi_{t-1}$  the updated probability that the government is non–predatory, given the sequence of moves from time 1 to time  $t - 1$ . We characterize the Markovian strategies of the actors of the politico–economic game. The state variable is the reputation of the government,  $\pi_{t-1}$ , or equivalently on the no predation–path, the number of periods during which this government has shown restraint. Markov perfect equilibrium requires that each agent takes optimal actions, given its rational interpretation of past observations, summarized by  $\pi_{t-1}$ , and its rational anticipations about

the optimal actions taken in the continuation sub-games (see Maskin and Tirole, 2001).

We first show how citizens update their beliefs about the type of the government, based on its observed behavior. Second, we analyze the dynamics of entry in the modern sector, in line with the evolution of political expectations, and the resultant growth paths. As political expectations improve, and citizens enter the modern sector, output per capita increases and, as shown below, the distribution of income alters. Finally, we characterize the dynamic strategy of the government.

#### 4.1. The dynamics of political risk

Denote by  $\lambda_t$  the probability that the government will show restraint at time  $t$  given the information set of the agents in the economy:

$$\lambda_t = \pi_{t-1} + (1 - \pi_{t-1})\mu_t. \quad (4.1)$$

The dynamics of  $\pi_{t-1}$  as a function of  $\mu_t$  and the sequence of moves is given in the next lemma:

**Lemma 1:** *As soon as the government predate,  $\pi_{t-1}$  goes to 0. If the government has not predated at time  $1, \dots, t-1$ , the probability that it is benevolent is:*

$$\pi_{t-1} = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\mu_1 \dots \mu_{t-1}}.$$

Lemma 1 implies that, on the no-predation path, the probability that the government is benevolent increases, i.e., the reputation of the government improves over time. On the other hand, when the government predate, its reputation is permanently destroyed.

#### 4.2. Private sector choices

Citizens who choose to operate in the traditional sector receive their marginal product, equal to 1. Those who choose to operate in the modern sector at time  $t$  receive their wage  $w_t$ , if the government does not predate, or if, after attempting to predate, it is overthrown. Again, equilibrium in the labour market implies that citizens be indifferent between self-employment in the informal sector and employment in the modern sector. Hence:

$$w_t = \frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)}. \quad (4.2)$$

When political risk is large, there is a large probability that the government will predate and wages will not be paid. To compensate for this risk, employees must be promised a relatively high wage in the case where the government does not predate. This risk premium generates a wedge between the wage promised in the modern sector and the traditional or informal sector; the greater the political risk, the larger this wedge.

Taking the wage rate as given, the modern sector firms choose how many workers to hire to maximize expected profits:

$$\text{Max}_{\beta_t \in [0,1]} (\lambda_t + (1 - \lambda_t)\nu(\beta_t))(Y(\beta_t) - \beta_t w_t).$$

Note that political risk reduces expected profits in the modern sector by raising both the equilibrium wages and the probability that profits will be expropriated. Substituting in the equilibrium wage, expected profits in the modern sector are:

$$(\lambda_t + (1 - \lambda_t)\nu(\beta_t))Y(\beta_t) - \beta_t.$$

The solution of this program is given in the next lemma:

**Lemma 2:** *If  $\lambda_t = 1$ , then all citizens operate in the modern sector. If  $\lambda_t = 0$ , then all citizens operate in the traditional sector. For interior values, the fraction of citizens employed in the traditional sector,  $\beta_t$ , is an increasing function of  $\lambda_t$ :*

$$\beta_t = B(\lambda_t). \tag{4.3}$$

As shown in the proof of the Lemma, for interior values of  $\lambda_t$ , the fraction of the population operating in the formal sector is given by the first order condition:

$$Y'(\beta_t) = w_t = \frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)},$$

which simply equates the marginal productivity of labor to wages in the modern sector. The greater the political risk, the greater the wages necessary to attract agents in the modern sector. As the probability that there will be no predation ( $\lambda_t$ ) rises from 0 to 1, the fraction of the population working in the formal sector ( $B(\lambda_t)$ ) increases from 0 to 1. Since the modern sector is more productive than the traditional one, GDP per capita is increasing in  $\lambda_t$ , i.e., it is decreasing in political risk.

As mentioned above, an example of production function is:  $Y(\beta_t) = k(\beta_t)^\alpha$  while a parametrization for the probability that citizens can successfully resist predations is  $\gamma\beta_t^\eta$ . In the simple square root case where  $\alpha = \eta = \frac{1}{2}$ , we obtain a closed form solution for the fraction of the population working in the formal sector, as a function of the probability of restraint, as stated in the following corollary:

**Corollary 1:** *When  $\alpha = \eta = \frac{1}{2}$ , the fraction of the population working in the formal sector is:*

$$B(\lambda_t) = \left[ \frac{1}{\lambda_t} - \frac{1 - \lambda_t}{\lambda_t} \gamma \right]^{-2}.$$

We employ this expression in a later section to illustrate our results.

### 4.3. The program of the opportunistic government

We now analyze the problem from the point of view of the opportunistic government. Once the government has preyed, its reputation is ruined; citizens permanently exit the vulnerable modern sector and there is no further predatory gain. Denote by  $J_t$  the value function of the opportunistic government if it has not preyed until time  $t$ . The expected utility of the government when it engages in predation is the product of the probability that the government will stay in power and the output it can then expropriate. Denote this expected gain by  $\varphi(\beta_t)$ :

$$\varphi(\beta_t) = (1 - \nu(\beta_t))Y(\beta_t),$$

To facilitate the computations, we assume that  $\varphi$  is continuous and concave. In the square root parametrization used in the example above:

$$\varphi(\beta) = 2(\beta^{\frac{1}{2}} - \gamma\beta),$$

which is indeed concave.

Denote by  $J_t$  the value function of the opportunistic government after  $t$  periods of restraint. It is defined by the following Bellman equation:

$$J_t = \text{Max}_{\mu_t \in [0,1]} \{ (1 - \mu_t)\varphi(\beta_t) + \mu_t \delta_G J_{t+1} \}.$$

As long as the opportunistic government shows some restraint, i.e., as long as  $\mu_t > 0$ , the first order condition states that the government is indifferent between

immediate predation and restraint.<sup>10</sup> Thus, on the no-predation path:

$$J_t = \varphi(\beta_t) = \delta_G J_{t+1}.$$

This equality emphasizes the link between the value function of the government and the current level of development of the modern sector. Indeed, the latter determines how much the government can obtain if it predated immediately, thus anchoring its value function.

#### 4.4. Equilibrium strategies

From this infinite horizon game, a finite horizon emerges endogenously. Intuitively, as the number of periods without predation increases, the updated probability that the government is benevolent increases. This increased optimism generates an increase in the fraction of the population operating in the formal sector. The expansion of the modern economy, in turn, raises the attractiveness of predation for the opportunistic government. At some point the temptation grows so large that an opportunistic government can no longer resist. At this point, it predated.

To argue more formally, first define  $\beta^*$  as the level of development of the formal sector such that the opportunistic government is indifferent between predated now and waiting, anticipating that full development will take place at the next period:

$$\beta^* = \text{Min}\{\beta, \varphi(\beta) = \delta_G \varphi(1)\}.$$

Because  $\varphi$  is continuous and because  $0 = \varphi(0) \leq \delta_G \varphi(1) \leq \varphi(1)$ ,  $\beta^*$  exists. Because  $\varphi$  is concave and increasing at 0,  $\varphi$  is increasing between 0 and  $\beta^*$ . Furthermore,  $\beta^*$  is strictly lower than 1. These features of  $\varphi$  and  $\beta$  are illustrated in Figure 3.

Second, define  $\pi^*$  as the level of the probability that the government is benevolent, such that a fraction  $\beta^*$  of the citizens is willing to enter the modern sector, even while anticipating that the government, if opportunistic, would predate for sure, i.e.,  $\beta^* = B(\pi^*)$ . Since  $B$  is increasing it is invertible. Hence, we can write  $\pi^*$  as:

$$\pi^* = B^{-1}(\beta^*).$$

The next proposition directly stems from the definition of  $\beta^*$  and  $\pi^*$ .

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<sup>10</sup>It's immediate to show that  $\mu_t = 1$  never arises in equilibrium. Were citizens to expect  $\mu_t = 1$ , then restraint at time  $t$ , while costly for the impatient government, would not improve its reputation.



**Proposition 1:** *When it reaches  $\pi^*$ , then the following is a Nash equilibrium of the continuation game: an opportunistic government always predates ( $\mu_t = 0$ ) and a fraction  $\beta^*$  of the citizens choose to enter the formal sector. If there is no predation at time  $t$ , then the economy reaches full development at the next period, i.e.,  $\beta_{t+s} = 1, \forall s \geq 1$ .*

In the square root parametrization, we obtain closed form solutions for  $\beta^*$  and  $\pi^*$ :

**Corollary 2:** *When  $\alpha = \eta = \frac{1}{2}$ :*

$$\beta^* = \left( \frac{1 - \sqrt{1 - 4\gamma(1 - \gamma)\delta_G}}{2\gamma} \right)^2 \text{ and } \pi^* = \frac{1 - \gamma}{\frac{1}{\sqrt{\beta^*}} - \gamma}.$$

Denote by  $T$  the endogenous, horizon of our politico-economic game. After observing  $T - 1$  periods without predation, the probability that the government is benevolent reaches  $\pi^*$ .<sup>11</sup> Thus, at time  $T$ , by construction, the value function of the government is:

$$J_T = \delta_G \varphi(1).$$

Before time  $T$ , the government follows a mixed strategy and thus is indifferent between predation and restraint. Hence:

$$J_{T-1} = \varphi(\beta_{T-1}) = \delta_G^2 \varphi(1).$$

Iterating:

$$J_{T-k} = \varphi(\beta_{T-k}) = \delta_G^{k+1} \varphi(1).$$

As noted in the following lemma, this expression pins down the value function of the opportunistic government and the fraction of the population operating in the modern sector on the no-predation path.

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<sup>11</sup>Because we work in discrete time, we face an integer number problem: at time  $T - 1$ , the conditional probability that the government is opportunistic is strictly below  $\pi^*$ , and at time  $T$  it is (generically) strictly above. To avoid technicalities, we neglect the integer problem, and work as if at time  $T$  the updated probability that the government is opportunistic just reached  $\pi^*$ .

**Lemma 3:** *On the no-predation path,  $\forall t \leq T$ , the opportunistic government value function is:*

$$J_t = \delta_G^{T+1-t} \varphi(1), \quad (4.4)$$

*and the fraction of the population working in the modern sector is:*

$$\beta_t = \varphi^{-1}(\delta_G^{T+1-t} \varphi(1)). \quad (4.5)$$

The mixed strategy indifference condition implies that the value function of the opportunistic government on the no-predation path is the present value of its payoff at the endogenous final date  $T$ , as stated in equation (4.4). This value function increases with time. The indifference condition also implies that the fraction of the population operating in the modern sector is  $\varphi^{-1}(J_t)$ . Since  $\varphi(\cdot)$  is increasing between 0 and  $\beta^*$ ,  $\beta_t$  also increases with time on the no-predation path. In the square root example, Lemma 3 implies the following corollary (which can be obtained similarly to Corollary 2):

**Corollary 3:** *In the square root parametrization, the value function of the opportunistic government on the no-predation path is:*

$$J_t = 2\delta_G^{T+1-t}(1 - \gamma),$$

*while the fraction of the population employed in the modern sector is:*

$$\beta_t = \left( \frac{1 - \sqrt{1 - 4\gamma(1 - \gamma)\delta_G^{T+1-t}}}{2\gamma} \right)^2.$$

The corollary illustrates that the value function of the opportunistic government increases with its patience and decreases with the ability of citizens to resist expropriation. It also illustrates that both the value function of the government and the fraction of the population employed in the modern sector increase with time.

Turning to the dynamics of political risk, Equation (4.3), expresses the fraction of the population operating in the modern sector in a given period as a function of the probability that there will be no predation during that period. Since this function is increasing, it can be inverted, which yields:

$$\lambda_t = B^{-1}(\beta_t).$$

Substituting the equilibrium fraction of the population employed in the modern sector from equation (4.5), we obtain the following lemma:

**Lemma 4:** *After  $t-1$  periods without predation, the citizens evaluate the probability of no current predation to:*

$$\lambda_t = B^{-1}(\varphi^{-1}(\delta_G^{T+1-t}\varphi(1))),$$

*which is increasing in  $t$ .*

Summarizing the above results, on the no-predation path the modern sector gradually increases in size. So too does per capita income and the ability of the civil society to resist expropriation. During this process, political risk decreases. Our theoretical analysis thus offers an equilibrium interpretation for the jointly endogenous evolution of the economy and the polity. But, even with successful development, in equilibrium, as long as  $t < T + 1$ , predation can occur.

Returning to the square root parametrization, taking steps similar to those in Corollary 2, and relying on Corollary 3, the value of  $\lambda_t$  can be explicitly computed:

**Corollary 4:** *In the square root parametrization, the probability that there is no predation at time  $t$ , if there was no predation before is:*

$$\lambda_t = \frac{1 - \gamma}{\frac{1}{\sqrt{\beta_t}} - \gamma} = \frac{\frac{1}{2} - 1}{1 - \sqrt{1 - 4\gamma(1-\gamma)\delta_G^{T+1-t}} - 1}.$$

To complete the characterization of equilibrium strategies, we need to determine the strategy of the opportunistic government and the political beliefs, i.e., the evolution of  $\mu_t$  and  $\pi_{t-1}$ , on the no predation path. This can be achieved by relying on the implications of Bayes rule for the dynamics of beliefs (Lemma 1), and combining the analysis of private sector choices (Lemma 2) with that of the government strategy (Lemma 3 and Lemma 4).

**Proposition 2:** *There exists an equilibrium whereby after a sufficiently long time without predation the updated probability that the government is benevolent reaches  $\pi^*$ . On the no-predation path, the equilibrium probability that the opportunistic government refrains from predation is:*

$$\mu_t = \frac{\lambda_1 \dots \lambda_t - \pi_0}{\lambda_1 \dots \lambda_{t-1} - \pi_0} = \frac{\prod_{s=1}^t B^{-1}(\varphi^{-1}(\delta_G^{T+1-s}\varphi(1))) - \pi_0}{\prod_{s=1}^{t-1} B^{-1}(\varphi^{-1}(\delta_G^{T+1-s}\varphi(1))) - \pi_0}, \forall t > 1 \text{ and } \mu_1 = \frac{\lambda_1 - \pi_0}{1 - \pi_0},$$

while the equilibrium probability that the government is benevolent is:

$$\pi_{t-1} = \frac{\pi_0}{\lambda_1 \dots \lambda_{t-1}} = \frac{\pi_0}{\prod_{s=1}^{t-1} B^{-1}(\varphi^{-1}(\delta_G^{T+1-s} \varphi(1)))}, \forall t > 1,$$

#### 4.5. The dynamics: equilibrium divergence and unstable growth

In equilibrium, the dynamics of the political and economic variables can be modeled as a discrete Markov Chain, with  $T + 2$  states. The underlying state variable is the number of periods without predation, or, equivalently the updated probability that the current government is benevolent. Correspondingly, we label the states by the tenure of the non predatory government. State 1 means that it is the first period during which the government is in office, either because the game is just starting or because the previous government has been overthrown and a new one has just been drawn. Similarly, state 2 means that, the government currently in place was new last period and did not predate then. We also label by 0 the state where the government has already been observed to predate and has not been overthrown.

- In **state 0** the government is known to be predatory. Accordingly no citizen dares to enter the politically vulnerable modern sector. Hence  $\beta = Y = 0$ .
- In **state 1**, the probability that the government is benevolent is  $\pi_0$  and the fraction of the population working in the modern sector is:  $\beta_1 = B(\lambda_1)$ .
- **State**  $t \in \{2, \dots, T\}$  arises after the government has been observed to show restraint during  $t - 1$  periods. In that case, the probability that the government is benevolent is  $\pi_{t-1}$  and the fraction of the population working in the modern sector is:  $\beta_t = B(\lambda_t)$ .
- **State**  $T + 1$  arises after the government has been observed to show restraint during  $T$  periods. In that case, the government is known to be benevolent, and full development obtains, with  $\beta_{T+1} = 1$ .

The analysis above, and in particular on Proposition 2, yield the transition probabilities that attach to each state. Interpreting  $\delta_G$  as the probability that there is no exogenous political shock, we obtain the following:

- Once the economy reaches state 0, it is trapped there until the government is overthrown because of an exogenous event, such as an invasion or a coup. After such an exogenous shock (which happens with probability  $1 - \delta_G$ ), the economy moves to state 1.
- From state  $t \in \{1, \dots, T\}$  the economy can go to state 1 if there is an exogenous political shock. Otherwise, if the government shows restraint the economy moves to state  $t+1$ . This transition, corresponding to gradual economic development, happens with probability  $\delta_G \lambda_t$ . But if the government is observed to predate, the economy collapses. If the predatory government is overthrown, the economy moves to state 1, where it gets a fresh start. This sequence of events happens with probability  $\delta_G(1 - \lambda_t)\nu(\beta_t)$ . If the predatory government stays in power, the collapse is durable, as the economy moves to state 0. This sequence of events happens with probability  $\delta_G(1 - \lambda_t)(1 - \nu(\beta_t))$ .
- Once the economy reaches state  $T + 1$ , full development obtains. Full development persists with probability  $\delta_G$ . If there is an exogenous political shock, which happens with probability  $1 - \delta_G$ , the economy moves back to state 1.

The dynamics of this Markov chain are illustrated in Figure 4. As illustrated in the figure, the Markov chain is irreducible, i.e., starting from any of the states it is possible to get to any of the other states. It is also aperiodic. Therefore it admits a unique ergodic distribution. The transition probability matrix, which we denote by  $M$ , is:

$$M = \begin{pmatrix} \delta_G & 1 - \delta_G & 0 & 0 & \cdot & \cdot & 0 \\ \delta_G(1 - \lambda_1)(1 - \nu(\beta_1)) & (1 - \delta_G) + \delta_G(1 - \lambda_1)\nu(\beta_1) & \delta_G \lambda_1 & 0 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \delta_G(1 - \lambda_t)(1 - \nu(\beta_t)) & (1 - \delta_G) + \delta_G(1 - \lambda_t)\nu(\beta_t) & 0 & \cdot & \delta_G \lambda_t & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \delta_G(1 - \lambda_T)(1 - \nu(\beta_T)) & (1 - \delta_G) + \delta_G(1 - \lambda_T)\nu(\beta_T) & 0 & \cdot & \cdot & \cdot & \delta_G \lambda_T \\ 0 & 1 - \delta_G & 0 & \cdot & \cdot & \cdot & \delta_G \end{pmatrix}. \quad (4.6)$$

The ergodic distribution is the probability vector  $P$  such that:  $MP = P$ . It is given in the next proposition:

**Proposition 3:** *In the ergodic distribution, the  $T + 2$  possible states of the economy have with equal weight.*

The proposition implies that most of the time ( $T$  periods out of  $T + 2$ ), the agents in the economy are unsure about the exact type of the government. The government has not been observed to predate, and thus some fraction  $\beta_t \in ]0, \beta^*]$  of the agents choose to operate in the modern sector.  $\frac{1}{T+2}$  of the time, however, the government is known to be predatory, and no one dares to enter the politically vulnerable sector. Also,  $\frac{1}{T+2}$  of the time, the government is known to be benevolent, and the economy has reached full development.

The ergodic distribution arising in our equilibrium thus exhibits divergence, in line with the empirical findings (Maddison, 1995). The empirical literature also suggests that growth paths are unstable (Pritchett, 2000) and the changes unpredictable (Hausman et al, 2004). The equilibrium dynamics in Proposition 2 and 3 also match these findings.

## 5. Robustness and extensions

In this section, we extend our analysis above by considering less stylized assumptions. In this context, we discuss the robustness of our results.

### 5.1. Democracies

We have assumed that even if the country has reached full development ( $\beta = 1$ ) there is still some risk that, because of an exogenous shock, the government will be overthrown, and a new government will come in power, with a relatively low reputation. This assumption may not be appropriate for the industrialized western democracies. For these countries, it might be more adequate to assume a lower risk of exogenous political shock. To account for this, assume that, when the economy has reached full development and is in state  $T + 1$ , then the probability of exogenous political crises goes down and  $\delta_G$  goes up to  $\bar{\delta}_G$ . Note that this does not qualitatively change the equilibrium of our politico-economic game. The corresponding ergodic distribution is given in the following proposition:

**Proposition 4:** *If the probability of exogenous political shocks goes down to  $1 - \bar{\delta}_G$  in the full development case, then the equilibrium ergodic distribution is:*

$$p_{T+1} = \frac{\frac{1-\delta_G}{1-\delta_G}}{T+1 + \frac{1-\delta_G}{1-\delta_G}} \text{ and } p_t = \frac{1}{T+1 + \frac{1-\delta_G}{1-\delta_G}}, t \in \{0, 1 \dots T\}.$$

Moreover, as  $\bar{\delta}_G$  goes to one, the long term probability of state  $T+1$  goes to one, i.e., full development becomes an absorbing state.

## 5.2. Permanent limited predation versus predatory outbursts

We have assumed the benevolent government never wants to predate. What if that government was only moderately benevolent and extracted a limited quantity of resources from the private sector for its own consumption? To shed light on this case, assume the benevolent government always taxes a fraction  $\theta$  of the modern sector output, while keeping the assumption that the traditional informal sector escapes government predation. Depending on parameter values, there are now two possible equilibria: one in which the opportunistic government permanently pools with the benevolent one, thus permanently limiting predation; the other where the opportunistic government only temporarily pools with the benevolent one, eventually opting for total predation. While the former equilibrium is similar to that analyzed by Besley (1997), the latter is only a variant of the equilibrium we analyzed above.

Consider first the permanent limited predation equilibrium. All citizens and firms anticipate that both types of government will permanently tax a fraction  $\theta$  of  $Y$ . Were the opportunistic government to deviate from such limited predation, then all citizens would interpret this as a signal that the government is predatory and permanently revert to the traditional sector. Since predation is only limited, firm profits are sufficient to pay wages. The equilibrium condition that citizens be indifferent between the two sectors therefore implies:  $w = 1$ . In this context, firms choose  $\beta$  to maximize:

$$(1 - \theta)Y(\beta) - \beta.$$

The first order condition is:

$$(1 - \theta)Y'(\beta) = 1,$$

and the second order condition holds since  $Y$  is concave. The equilibrium proportion of citizens working in the modern sector is therefore:

$$\hat{\beta} = Y'^{-1}\left(\frac{1}{1 - \theta}\right).$$

Given our assumptions on  $Y$ , this implies that  $\beta < 1$ . While, without taxation, all citizens operate in the more productive modern sector, limited predation thus encourages some of them to remain in the traditional sector, which is shielded from government interference.

Now, turn to the strategy of the opportunistic government. Were it to choose permanent limited predation, its discounted utility would be:

$$\sum_{t=0}^{\infty} \delta_G^t \theta Y(\hat{\beta}) = \frac{\theta Y(\hat{\beta})}{1 - \delta_G},$$

while if it chose instant total predation it would get:

$$\varphi(\hat{\beta}) = (1 - \nu(\hat{\beta}))Y(\hat{\beta}).$$

The condition yielding permanent limited predation therefore is:

$$\frac{\theta}{1 - \delta_G} \geq (1 - \nu(Y'^{-1}(\frac{1}{1 - \theta}))). \quad (5.1)$$

Both sides of the condition are continuous and increasing in  $\theta$ . The left hand-side increases from 0 to  $1/(1 - \delta)$ , as  $\theta$  goes from 0 to 1, the right-hand-side increases from  $1 - \nu(1)$  to  $1 - \nu(0)$ . So the two curves cross at least once. Hence, there exist some values of  $\theta$  for which condition (5.1) holds and some for which it does not hold. If the left-hand-side and right-hand-side of (5.1) cross only once, then the condition holds whenever  $\theta$  is above that crossing point. Notice that the left-hand side of (5.1) depends on  $\delta_G$ , while the right-hand side does not. Hence, limited predation can be an equilibrium when  $\delta_G$  is large enough, while a higher rate of impatience would preclude it.

Relying on condition (5.1), we can state the following result:

**Proposition 5:** *There exists an equilibrium where both government types permanently exert limited predation, by taxing a fraction  $\theta$  of the modern sector output, if and only if condition (5.1) holds.*

This corresponds to the case analyzed by Besley (1997), where the opportunistic government prefers a limited but long-lived rent rather than one shot predation revenues. But what if condition (5.1) does not hold? In that case the equilibrium is similar to that analyzed in the Section 4. The opportunistic government strategically mixes between restraint (with probability  $\mu_t$ ) and predation. Along the no predation path, citizens upgrade their expectations about the type



of the government. And, if the government is opportunistic, at some point predation occurs. To use Olson’s terminology, when condition (5.1) holds, the state is a “stationary bandit.” When that condition does not hold, the opportunistic government initially mimics the “stationary bandit.” But eventually it turns into a “roving bandit.”

Since the logic is exactly the same as in the sections above, for brevity we only sketch the formal analysis of the latter case. Bayesian updating by the citizens is still as in Lemma 1 and wages in the modern sector are as in Section 4.2. Similarly to that section, the profit maximization condition for the modern sector firms is:

$$Y'(\beta_t)(1 - \theta) = \frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)},$$

which implicitly defines the function  $\hat{B}(\cdot)$ , mapping the probability of restraint,  $\lambda_t$ , into the fraction of the citizens working in the modern sector. Also, similarly to Section 4.3, the Bellman equation for the opportunistic government is:

$$J_t = \text{Max}_{\mu_t \in [0,1]} (1 - \mu_t)\varphi(\beta_t) + \mu_t[\theta Y(\beta_t) + \delta_G J_{t+1}].$$

Thus, along the no predation path, we have the following indifference condition:

$$(1 - \nu(\beta_t) - \theta)Y(\beta_t) = \delta_G J_{t+1}.$$

As in the above sections, one can then characterize the endogenous horizon of this game, recursively compute the value function of the government and close the equilibrium by solving for the sequence of updated probabilities.

While the logic and qualitative features of the equilibrium are the same as in the above sections, some aspects differ. First, for a given level of political expectations ( $\lambda_t$ ), the fraction of citizens working in the modern sector is lower than when there was no taxation. Second, for a given level of output in the modern sector, the ability to obtain limited taxes reduces the temptation for the opportunistic government to engage in full predation. Combining these remarks, we see that permanent limited predation by the benevolent government slows down growth but also makes it politically more sustainable. Thus weak taxation institutions, typical of poor countries, enhance political risk.

## 6. Implications

This section discusses implications of our theoretical investigation. First, we illustrate the properties of the model in the context of a numerical example. Then, we present empirical implications of our analysis.

## 6.1. Numerical example

In this subsection, we draw on the square root parametrization of our model. By doing so we reengage with the theoretical and empirical issues that motivate this paper.

Start with an a priori probability of governmental benevolence  $\pi_0 = 1\%$ , and set the discount rate of the government  $\delta_G$  at .945, and the ability of civil society to resist predation  $\gamma$  at .55. Solving for the endogenous horizon of the politico-economic game, we find that  $T = 4$ : after observing 3 periods without predation, the updated probability that the government is benevolent reaches  $\pi^*$ , which in this case is worth .48, and the fraction of the population operating in the modern sector reaches  $\beta^*$ , which in this case is .46. The Markov Chain has 6 states, labelled: 0, 1, 2, 3, 4, and 5. The transition probability matrix is:

$$M = \begin{pmatrix} .945 & .055 & 0 & 0 & 0 & 0 \\ 0.48 & .233 & .287 & 0 & 0 & 0 \\ 0.434 & .238 & 0 & .327 & 0 & 0 \\ 0.378 & .241 & 0 & 0 & .380 & 0 \\ 0.30 & .236 & 0 & 0 & 0 & .460 \\ 0 & .055 & 0 & 0 & 0 & .945 \end{pmatrix}.$$

In the ergodic distribution, the economy spends one sixth of the time in each of the two extreme states, where there is either full development ( $\beta = 1$ ) or no development at all ( $\beta = 0$ ). Two thirds of the time, the economy is in one of the transient states, 1,2,3 or 4, where there is progressive learning about the type of the government. This numerical example highlights some of the differences between the properties of equilibrium in our model and in standard institutionalist analyses. In the latter, good institutions foster development by placing predation off the equilibrium path. In contrast, in the numerical example above, one-sixth of the economies achieve full development, although predation can occur with positive probability.

Extending our numerical analysis, we can study how changes in parameter values lead to changes in economic and political outcomes.

**Varying  $\gamma$ :** First we examine the consequences of changing the institutions to increase the ability of the civil society to resist predation. To do so, we keep all the parameters the same, save  $\gamma$  which we raise from .55 to .6 and then to .66. Solving for the equilibrium endogenous horizon, we find that, as  $\gamma$  increases,  $T$

becomes shorter: for  $\gamma = .6$ ,  $T = 3$ , while for  $\gamma = .66$ ,  $T = 2$ . (The corresponding dynamics of  $\beta_t$  and  $\mu_t$  on the no predation path are illustrated in Figure 5.)

A better understanding of the model can be attained by exploring the reasons for  $T$ 's decline. As  $\gamma$  increases, the cost of waiting increases for the government. Waiting implies an increase in  $\beta$ , and correspondingly an increase in the probability of being overthrown after predation. If opportunistic, the government will therefore predate faster. This result contrasts with the expectations that flow from the literature on institutions. In this example, good institutions do not check the hand of the government. They provoke it to predate sooner.

Figure 5 illustrates the point. Before the endogenous horizon of the game, the probability that the opportunistic government shows restraint is lower when  $\gamma$  is large.

Note too however that when  $\gamma$  is large, observing that predation did *not* take place conveys a strong signal about the benevolence of the government. Hence,  $\pi_t$  is strongly updated on the no predation path. But sharper increases of  $\pi_t$  on the no predation path imply that it reaches  $\pi^*$  more rapidly, or that the endogenous horizon of the game is shorter.

Thus, greater values of  $\gamma$  lead to more contrasted political and economic histories: if predation occurs, it takes place earlier; but the civil society reacts more strongly and the economy grows faster when predation has not been observed.

**Varying  $\delta_G$ :** Now let the government feel more insecure, whether because of rising international pressures or some other exogenous change in its political environment. To make this point, keep the same numerical values as above except for the probability that there is no exogenous political shock, and lower  $\delta_G$  to .883. This shortens the equilibrium endogenous horizon to  $T = 3$ . In this environment, refraining from predation sends a stronger signal, as the cost of waiting rises with insecurity. Hence, the updated probability that the government is benevolent reacts more strongly to the observation that there has been no predation. And on the no predation path higher rates of growth result.

## 6.2. Empirical implications

**For growth:** Some countries generate “hills”, in Pritchett’s (2000) phrasing; they experience steady growth. Other countries generate “mountains”; in these cases, positive and rapid initial growth is followed by economic decline. Note how the dynamics arising in our theoretical analysis recreate such patterns.

In our model, “hills” can arise in equilibrium as the period of time without predation lengthens and political confidence, i.e. the probability that the government is benevolent ( $\pi_{t-1}$ ) increases as well. The probability that the government will refrain from predation ( $\lambda_t$ ) also increases. Correspondingly the fraction of the population choosing to operate in the modern sector rises. This leads to an increase in GDP, in line with the case of Botswana discussed in the introduction. “Mountains” can also arise on the equilibrium path: if the government is not benevolent, it will predate. In that case, confidence in the current government permanently disappears, and income per capita plummets. This fits the case of Zimbabwe, discussed at the beginning of this paper.

It has also be noted that growth is more volatile in the early stages of economic development than in mature economies. As written by Lucas (1988, page 4): “within the advanced countries growth rates tend to be stable over long periods of time,” while among developing countries: “there are many examples of sudden, large changes in growth rates.” Our model generates a similar pattern.<sup>12</sup> Risk, in our analysis, relates to the danger of predation, which precipitates economic collapse. Consider the random variable taking the value one when predation occurs and 0 otherwise. Its variance,  $\sigma_t^2 = \lambda_t(1 - \lambda_t)$ , is a measure of risk in our model. In the early stages of development, as the economy grows, so too does risk, since both  $\lambda_t$  and  $\sigma_t^2$  increase on the no-predation-path. Once  $\lambda_t > \frac{1}{2}$ , which corresponds to a more mature economy, growth occurs simultaneously with a decline in risk.

**For inequality:** As noted above, the existence of political risk introduces a differential in the equilibrium wage of those working in the modern and traditional sectors of the economy: a person must be compensated for the risk of predation. Since our analysis is set in the context of a two-sector model where wages are greater in one sector than in the other, a Kuznets’curve can arise (see e.g Bourguignon, 1990). Initially all workers operate in the traditional sector and there is no inequality. Then, as long as the government does not predate, workers progressively move to the modern sector where they earn larger wages. This induces an increase in inequality. If the government does not predate, the majority of the population eventually moves to the modern sector and inequality decreases.

This point can be made more precise by considering the Lorenz curve and the Gini coefficient in our economy. In the Lorenz curve, the cumulative percentage of

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<sup>12</sup>Acemoglu and Zilibotti (1997) offer an interesting alternative approach, where early stage economies are more risky because they are less diversified.

population is plotted along the horizontal axis while the cumulative percentage of income is plotted along the vertical axis. The Gini coefficient is the area between the first diagonal and the Lorenz curve. In our model, this area is:

$$G = \frac{1}{2} \frac{(1 - \beta)\beta(w - 1)}{1 + \beta(w - 1)},$$

a function that is first increasing, then decreasing in  $\beta$ . Hence, along the no-predation path, the Gini coefficient tends to increase and then decrease, conforming to the logic of the Kuznets' curve.

The dynamics of political risk may therefore play a major role in shaping the evolution of income inequality. If the government predates, inequality drops sharply, as all workers go back to the low income traditional sector. If the government does not predate, the political premium impounded into wages goes down, and eventually  $w$  goes to 1. This contributes to reducing inequality. Hence, our model yields new implications for the dynamics of inequality: In a country with little political risk, and an initially quite reputable government, the initial increase in inequality is limited, and income inequality quickly washes away. In a country with large a priori political risk, the initial increase in inequality is stronger, since the political premium in wages is greater, and it takes longer for a reduction in inequality to obtain. Thus, our model predicts that countries with greater initial political risk should have more humped Kuznets' curves.

**For politics:** Jones and Olken (2004) find empirically that the death of an autocrat leads to improvements in growth. This finding is consistent with our theoretical analysis, where such a death would give rise to a transition from state 0 to state 1 and a corresponding shift in the growth path from one that yields durable stagnation to one along which growth could occur. This is illustrated by the case of Uganda, discussed at the beginning of this paper.

Przeworski et al. (2000), employing data drawn from a panel of 141 countries and 40 years (1950-1990) classify countries as either democratic or authoritarian and explore transitions between the two states. They find that in poorer countries, transitions to authoritarianism relate to reductions in the rate of growth (p. 109), that in wealthier countries, "democracies never die," and that the result is the generation of a cross section in which a greater portion of high income countries possess democratic governments. These findings are in line with the logic of our theoretical model and in particular the extension where full development can become an absorbing state (see Proposition 4).

Our analysis also delivers new empirical implications on political dynamics. As shown in the previous section, the stronger the institutions, the earlier the opportunistic government predate, and the stronger the improvement in political expectations and hence the economic growth following the absence of predation. Furthermore, the dynamics of political expectations is asymmetric. When governments adopt good, non predatory policies, political expectations improve gradually. When governments predate, political expectations are brutally downgraded.

## 7. Conclusion

This paper has advanced a model that provides a political explanation for the variety of growth experiences evidenced by the empirical literature (see e.g. Maddison, 2001, Pritchett, 1995 and 2000, or Hausmann et al, 2004.) We have shown how the process of development jointly endogenously involves economic growth, improved political expectations and the enhanced ability of the civil society to resist predation. We have also shown that the equilibrium political and economic histories arising in the context are unstable, and that predation and collapse can follow growth, and be themselves followed by economic rebound.

The major driver in this process is political restraint. Only liberal regimes that respect property rights, refrain from redistribution, and do not capriciously alter the rules of the game to their own economic advantage can achieve development.

But what of governments who have spoiled their reputations? Are their nations fated to remain poor? An implication of our argument is that such governments, having lost favorable reputations, will be unable to recover them. In such cases, growth will come only after major political changes, when new regimes - regimes with no apparent ties to the past - assume power. Of notable relevance to this argument is the finding by Haggard and Webb (1994) that regime rather than policy change was the better predictor of successful economic adjustment in the late 20th Century.

If the determinants of development lie in politics, then might not remedy lie in the shaping of political institutions? Our analysis cautions against the prescription of "best practice." Rather than focusing on institutions *per se*, we instead emphasize the ambience of expectations within which they lodge. Put another way: an institution that performs well in, say, North America would not, by our reasoning, achieve the same impact in Latin America (see Engerman and Sokoloff, 1997, and Engerman, Haber and Sokoloff, 2000). If only because the two regions possess different histories, economic agents will bring different

expectations to the market place and the political arena. In the two settings, responses to the incentives that an institution may generate will therefore differ, and so too its impact on economic performance. Institutional reform alone thus will not suffice to reduce political risk and to promote economic growth.

## Proofs

**Proof of Lemma 1:** If, at the first period, the government has not predated, then:

$$\pi_1 = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\mu_1}.$$

If, at the second period also, the government does not predate, then:

$$\pi_2 = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\mu_1\mu_2}.$$

Iterating, we obtain the value of the probability that the government is benevolent, updated along the no predation path, given in the lemma.

QED

### Proof of Lemma 2:

Firms in the modern sector are competitive, and thus do not take into account the impact of each recruiting decision on global political risk. Hence, they choose  $\beta_t$  to maximize:

$$(\lambda_t + (1 - \lambda_t)\nu)Y(\beta_t) - \beta_t,$$

taking  $\nu$  as given.

When  $\lambda_t = 1$ , the objective is:  $Y(\beta_t) - \beta_t$ , and the optimum is  $\beta_t = 1$ . When  $\lambda_t = 0$ , the objective is:  $-\beta_t$ , and the optimum is  $\beta_t = 0$ . To characterize the optimum for interior values of  $\lambda_t$  first note that the derivative of the objective function with respect to  $\beta_t$  is:

$$(\lambda_t + (1 - \lambda_t)\nu)Y'(\beta_t) - 1.$$

The second order condition holds since the production function is concave. The constraint  $\beta_t \leq 1$  is not binding since:

$$(\lambda_t + (1 - \lambda_t)\nu)Y'(1) - 1 = (\lambda_t + (1 - \lambda_t)\nu) - 1 < 0, \forall \lambda_t < 1.$$

The constraint  $\beta_t \geq 0$  is not binding since:



$$(\lambda_t + (1 - \lambda_t)\nu)Y'(0) - 1 \geq 0, \forall \lambda_t > 0.$$

Hence, the optimum is pinned down by the first order condition, i.e

$$Y'(\beta_t) = \frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)}. \quad (7.1)$$

Given the regularity conditions we have assumed, there exists a solution to that equation: first note that  $Y'$  is continuous. Second note that  $Y'$  tends to infinity as  $\beta_t$  goes to 0, while  $\frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)}$  remains finite. Third note that  $Y'$  is decreasing and reaches its minimum for  $\beta = 1$ . Finally note that:

$$Y'(1) = 1 \leq \frac{1}{\lambda_t + (1 - \lambda_t)\nu(1)}.$$

There may be more than one solution to equation (7.1), in this case, by convention, we pick the largest one.

Finally, we analyze the behavior of  $\beta_t$  as  $\lambda_t$  varies. Note that the left-hand-side of (7.1) can be rewritten as:

$$\frac{1}{\nu(\beta_t) + \lambda_t(1 - \nu(\beta_t))},$$

which is obviously decreasing in  $\lambda_t$ , while its right-hand-side,  $Y'(\beta_t)$ , is independent of  $\lambda_t$ . Hence, an increase in  $\lambda_t$  implies an increase in the value of  $\beta_t$  for which the two curves intersect.

QED

### Proof of Corollary 1:

The equation defining  $\beta_t$  is:

$$Y'(\beta_t) = \frac{1}{\lambda_t + (1 - \lambda_t)\nu(\beta_t)}.$$

In the square root case this is:

$$\frac{1}{\sqrt{\beta_t}} = \frac{1}{\lambda_t + (1 - \lambda_t)\gamma\sqrt{\beta_t}}.$$

That is:

$$\sqrt{\beta_t} = \frac{\lambda_t}{1 - (1 - \lambda_t)\gamma}.$$

Hence:

$$\beta_t = \left(\frac{1}{\lambda_t} - \frac{1 - \lambda_t}{\lambda_t}\gamma\right)^{-2}.$$

QED

**Proof of Proposition 1:**

By definition, when  $\pi_{t-1}$  reaches  $\pi^*$ , then a fraction  $\beta^*$  of the citizens enter the formal sector. Furthermore, since they anticipate that the opportunistic government always predated at this point in time, after observing no predation at time  $t$ , the citizens rationally update  $\pi_t$  to 1. Hence, if the opportunistic government waits another period before predating, his expected utility is:  $\delta_G \varphi(1)$ . Consequently, by construction of  $\beta^*$ , predating now is optimal for the opportunistic government.

QED

**Proof of Corollary 2:**

In the square root parametrization,

$$\varphi(\beta) = k(\sqrt{\beta} - \gamma\beta).$$

Thus,  $\beta^*$  is such that:

$$k(\sqrt{\beta} - \gamma\beta) = \delta_G k(1 - \gamma).$$

That is,

$$\gamma\beta^* - \sqrt{\beta^*} + \delta_G(1 - \gamma) = 0.$$

Denote,  $x = \sqrt{\beta^*}$ . It is the solution of the following quadratic:

$$\gamma x^2 - x + \delta_G(1 - \gamma) = 0.$$

The discriminant is:  $1 - 4\gamma(1 - \gamma)\delta_G$ . This is positive since  $\gamma(1 - \gamma) \leq \frac{1}{4}$  and  $\delta_G \leq 1$ . The quadratic has two roots:

$$\frac{1 - \sqrt{1 - 4\gamma(1 - \gamma)\delta_G}}{2\gamma} \text{ and } \frac{1 + \sqrt{1 - 4\gamma(1 - \gamma)\delta_G}}{2\gamma}.$$

The greater of the two roots is larger than one since:

$$\sqrt{1 - 4\gamma(1 - \gamma)\delta_G} > 2\gamma - 1,$$

if:

$$1 - 4\gamma(1 - \gamma)\delta_G > 4\gamma^2 - 4\gamma + 1,$$

that is:

$$-4\gamma(1 - \gamma)\delta_G > -4\gamma(1 - \gamma),$$

which holds since  $\delta_G \leq 1$ . Hence,

$$\beta^* = \left( \frac{1 - \sqrt{1 - 4\gamma(1 - \gamma)\delta_G}}{2\gamma} \right)^2.$$

Now turn to the computation of  $\pi^*$ . Substituting  $\pi^*$  in the equation defining  $B(\cdot)$ , and equating it to  $\beta^*$ :

$$B(\pi^*) = \frac{1}{\left[\frac{1}{\pi^*} - \frac{1 - \pi^*}{\pi^*}\gamma\right]^2} = \beta^*.$$

That is:

$$\frac{\pi^*}{\sqrt{\beta^*}} = [1 - (1 - \pi^*)\gamma] = 1 - \gamma + \gamma\pi^*.$$

Hence:

$$\pi^* = \frac{1 - \gamma}{\frac{1}{\sqrt{\beta^*}} - \gamma}.$$

QED

**Proof of Proposition 2:** The proof proceeds in three steps:

**First step:** Relying on Lemma 1, (4.1) and Bayes' law, we obtain  $\mu_t$  and  $\pi_{t-1}$  as a function of  $\lambda_t$ .

The probability of restraint at time 1 is:  $\lambda_1 = \pi_0 + (1 - \pi_0)\mu_1$ . This implies that:

$$\mu_1 = \frac{\lambda_1 - \pi_0}{1 - \pi_0}.$$

The proof proceeds by induction.

First we need to prove that the property holds at time 2, i.e., we must prove that:

$$\mu_2 = \frac{\lambda_1 \lambda_2 - \pi_0}{\lambda_1 - \pi_0},$$

The probability of restraint at time 2 is:  $\lambda_2 = \pi_1 + (1 - \pi_1)\mu_2$ . Thus:

$$\mu_2 = \frac{\lambda_2 - \pi_1}{1 - \pi_1}.$$

From Lemma 1:

$$\pi_1 = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\mu_1}.$$

Hence,

$$\mu_2 = \frac{\lambda_2[\pi_0 + (1 - \pi_0)\mu_1] - \pi_0}{(1 - \pi_0)\mu_1}.$$

Substituting in:  $\lambda_1 = \pi_0 + (1 - \pi_0)\mu_1$  and  $(1 - \pi_0)\mu_1 = \lambda_1 - \pi_0$ ,

$$\mu_2 = \frac{\lambda_2 \lambda_1 - \pi_0}{\lambda_1 - \pi_0},$$

which completes the first step of the proof.

Second we need to prove that, if the property holds until time  $t - 1$ , i.e.,

$$\mu_\tau = \frac{(\lambda_1 \dots \lambda_\tau) - \pi_0}{(\lambda_1 \dots \lambda_{\tau-1}) - \pi_0}, \forall \tau < t,$$

then it also holds at time  $t$ . By definition of  $\lambda_t$ :

$$\mu_t = \frac{\lambda_t - \pi_{t-1}}{1 - \pi_{t-1}}.$$

From Lemma 1:

$$1 - \pi_{t-1} = \frac{(1 - \pi_0)\mu_1 \dots \mu_t}{\pi_0 + (1 - \pi_0)\mu_1 \dots \mu_t}.$$

Substituting in  $\mu_t$ ,

$$\mu_t = \frac{\lambda_t[\pi_0 + (1 - \pi_0)\mu_1 \dots \mu_{t-1}] - \pi_0}{(1 - \pi_0)\mu_1 \dots \mu_{t-1}}.$$

That the property holds for all time  $\tau < t$ ;

$$\mu_1 = \frac{\lambda_1 - \pi_0}{1 - \pi_0}, \mu_\tau = \frac{(\lambda_1 \dots \lambda_\tau) - \pi_0}{(\lambda_1 \dots \lambda_{\tau-1}) - \pi_0}, \forall 1 < \tau < t.$$

implies that:

$$\mu_1 \dots \mu_{t-1} = \frac{\lambda_1 - \pi_0}{1 - \pi_0} \frac{\lambda_1 \lambda_2 - \pi_0}{\lambda_1 - \pi_0} \dots \frac{(\lambda_1 \dots \lambda_{t-1}) - \pi_0}{(\lambda_1 \dots \lambda_{t-2}) - \pi_0} = \frac{(\lambda_1 \dots \lambda_{t-1}) - \pi_0}{1 - \pi_0}.$$

Substituting  $\mu_1 \dots \mu_{t-1}$  into  $\mu_t$ , the result obtains, i.e.,:

$$\mu_t = \frac{(\lambda_1 \dots \lambda_t) - \pi_0}{(\lambda_1 \dots \lambda_{t-1}) - \pi_0}.$$

We now turn to the analysis of  $\pi_{t-1}$ . As shown above in this proof,

$$\mu_1 \dots \mu_{t-1} = \frac{(\lambda_1 \dots \lambda_{t-1}) - \pi_0}{1 - \pi_0}.$$

Substituting  $\mu_1 \dots \mu_{t-1}$  in  $\pi_{t-1}$ :

$$\pi_{t-1} = \frac{\pi_0}{\pi_0 + (1 - \pi_0)\mu_1 \dots \mu_{t-1}} = \frac{\pi_0}{\lambda_1 \dots \lambda_{t-1}}.$$

**Second step:** Relying on the first step we prove that there exists a time  $T$  at which  $\pi_{t-1}$  reaches  $\pi^*$ . Since, is increasing in  $t$ :

$$\pi_{t-1} = \frac{\pi_0}{\lambda_1 \dots \lambda_{t-1}} > \frac{\pi_0}{(\lambda_{t-1})^{t-1}} > \frac{\pi_0}{(\lambda_T)^{t-1}} = \frac{\pi_0}{(\pi^*)^{t-1}}.$$

Since  $\pi^*$  is a constant lower than 1, as  $t$  goes to infinity,  $\frac{\pi_0}{(\pi^*)^{t-1}}$  grows unboundedly. Hence there exists a value of  $t$  such that  $\pi_{t-1}$  reaches  $\pi^*$ .

**Third step:** Combining Lemma 4, which gives  $\lambda_t$  as a function of the exogenous parameters, and the previous step of the proof, which gives  $\mu_t$  and  $\pi_{t-1}$  as functions of  $\lambda_t$ , we obtain the strategy of the opportunistic government and the political beliefs of the citizens as a function of the exogenous parameters.

Substituting in the value of  $\beta_t$  from Lemma 3, we obtain the value of  $\lambda_t$  stated in the proposition:

$$\lambda_t = B^{-1}(\varphi^{-1}(\delta_G^{T+1-t} \varphi(1))).$$

Substituting  $\pi_{t-1} = \frac{\pi_0}{\lambda_1 \dots \lambda_{t-1}}$  in the value of  $\lambda_t$  given above:

$$\pi_{t-1} = \frac{\pi_0}{\lambda_1 \dots \lambda_{t-1}} = \frac{\pi_0}{\prod_{s=1}^{t-1} B^{-1}(\varphi^{-1}(\delta_G^{T+1-t} \varphi(1)))}.$$

Finally, substituting the value of  $\lambda_t$  into the value of  $\mu_t$ , given above:

$$\mu_t = \frac{(\lambda_1 \dots \lambda_t) - \pi_0}{(\lambda_1 \dots \lambda_{t-1}) - \pi_0} = \frac{\prod_{s=1}^t B^{-1}(\varphi^{-1}(\delta_G^{T+1-t} \varphi(1))) - \pi_0}{\prod_{s=1}^{t-1} B^{-1}(\varphi^{-1}(\delta_G^{T+1-t} \varphi(1))) - \pi_0}.$$

QED

**Proof of Proposition 3:**

$$MP = P = \begin{pmatrix} p_0 \\ \cdot \\ p_t \\ \cdot \\ p_{T+1} \end{pmatrix}.$$

Multiplying the first row of  $M$  by  $P$ , we obtain:

$$p_0 \delta_G + p_1 (1 - \delta_G) = p_0 \iff p_0 = p_1.$$

Multiplying the second row of  $M$  by  $P$ , we obtain:

$$p_0 \delta_G (1 - \lambda_1) (1 - \nu(\beta_1)) + p_1 ((1 - \delta_G) + \delta_G (1 - \lambda_1) \nu(\beta_1)) + p_2 \delta_G \lambda_1 = p_2.$$

Substituting  $p_0 = p_1$  and simplifying, we obtain:  $p_0 = p_2$ . Iterating, we find that all the elements of  $P$  are equal.

QED

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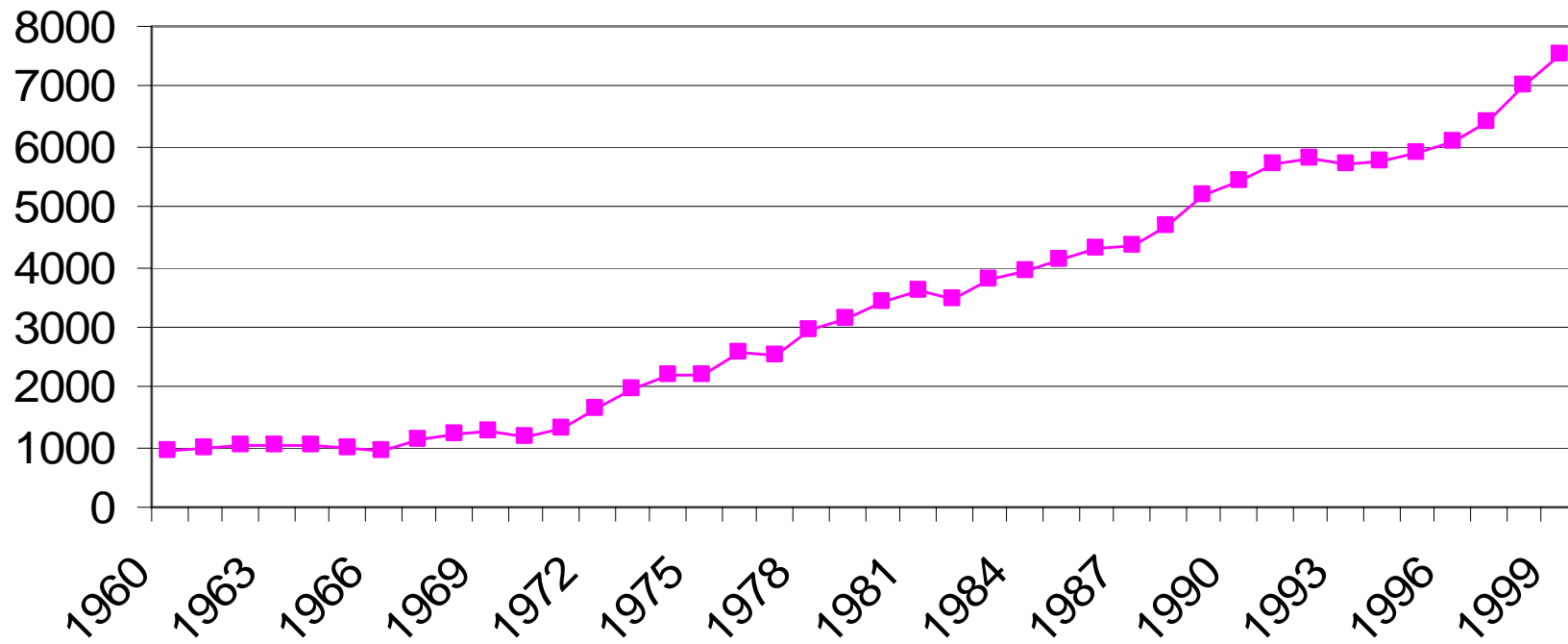
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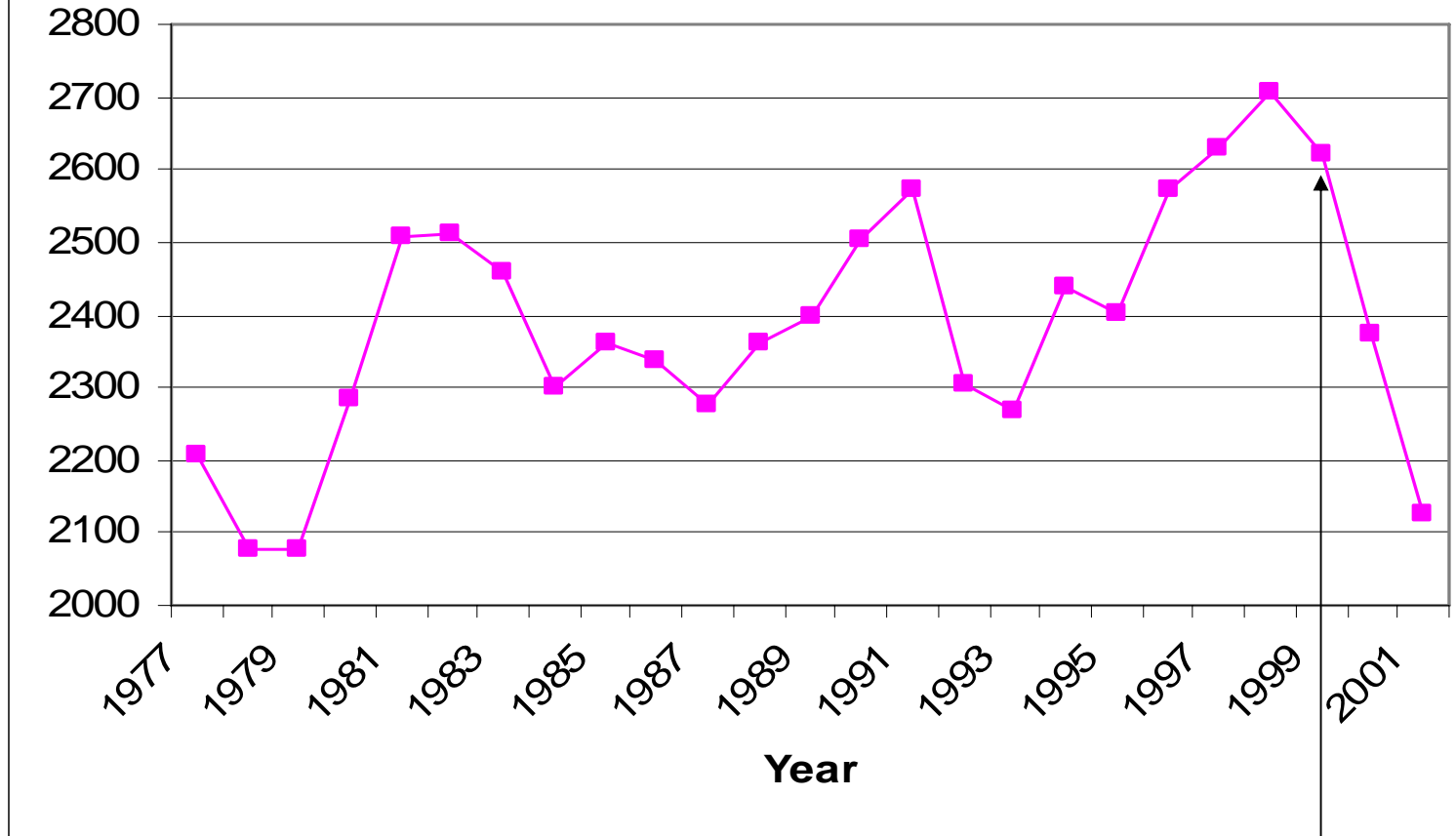


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**Figure 1, Panel A: Botswana Real GDP per Capita  
(Source Penn World Tables)**

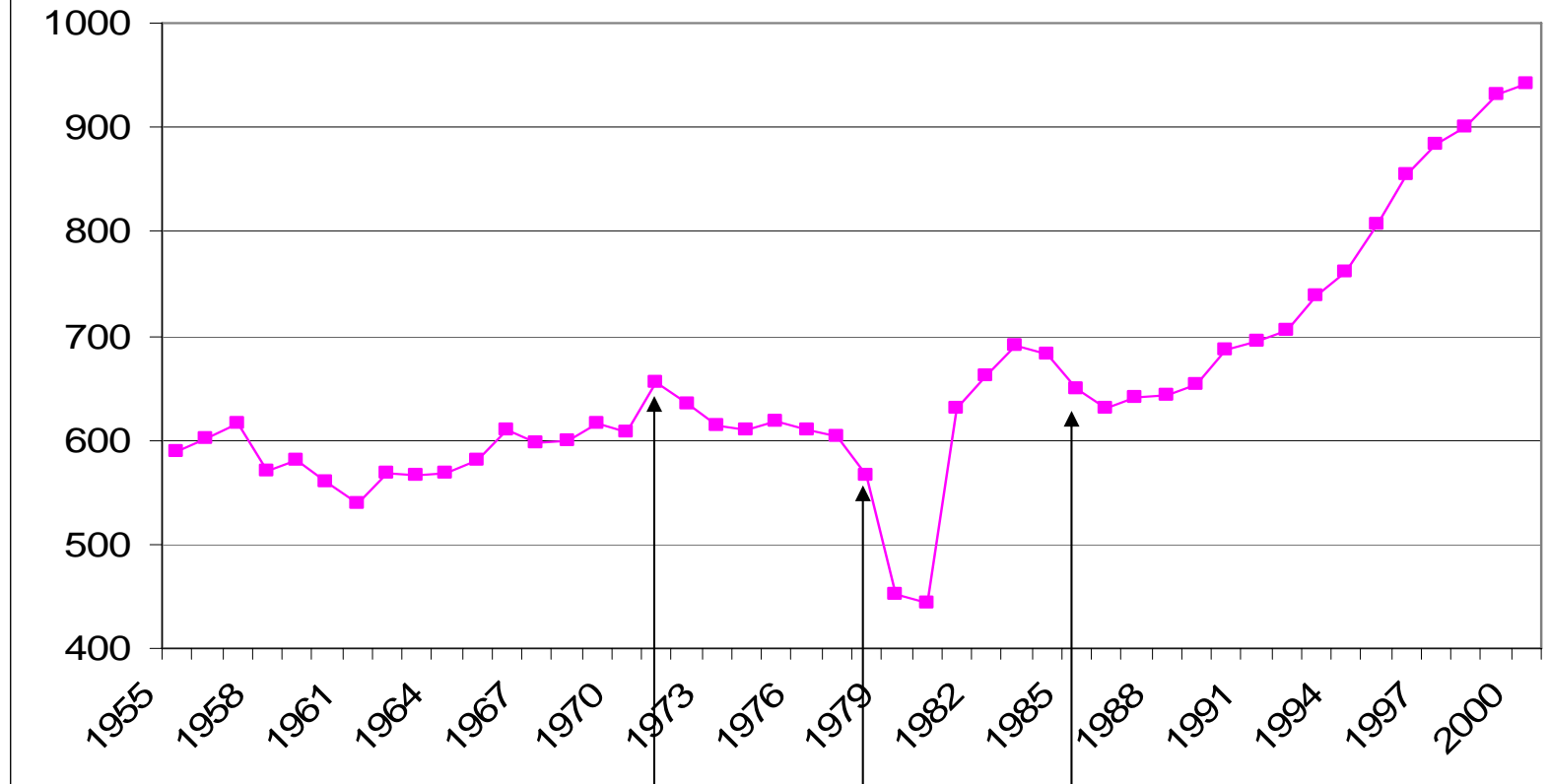


**Figure 1, Panel B: Zimbabwe Real GDP per Capita  
(Source World Bank)**



Mugabe engages in predation

**Figure 1, Panel C: Uganda Real GDP Per Capita  
(Source Penn World table)**

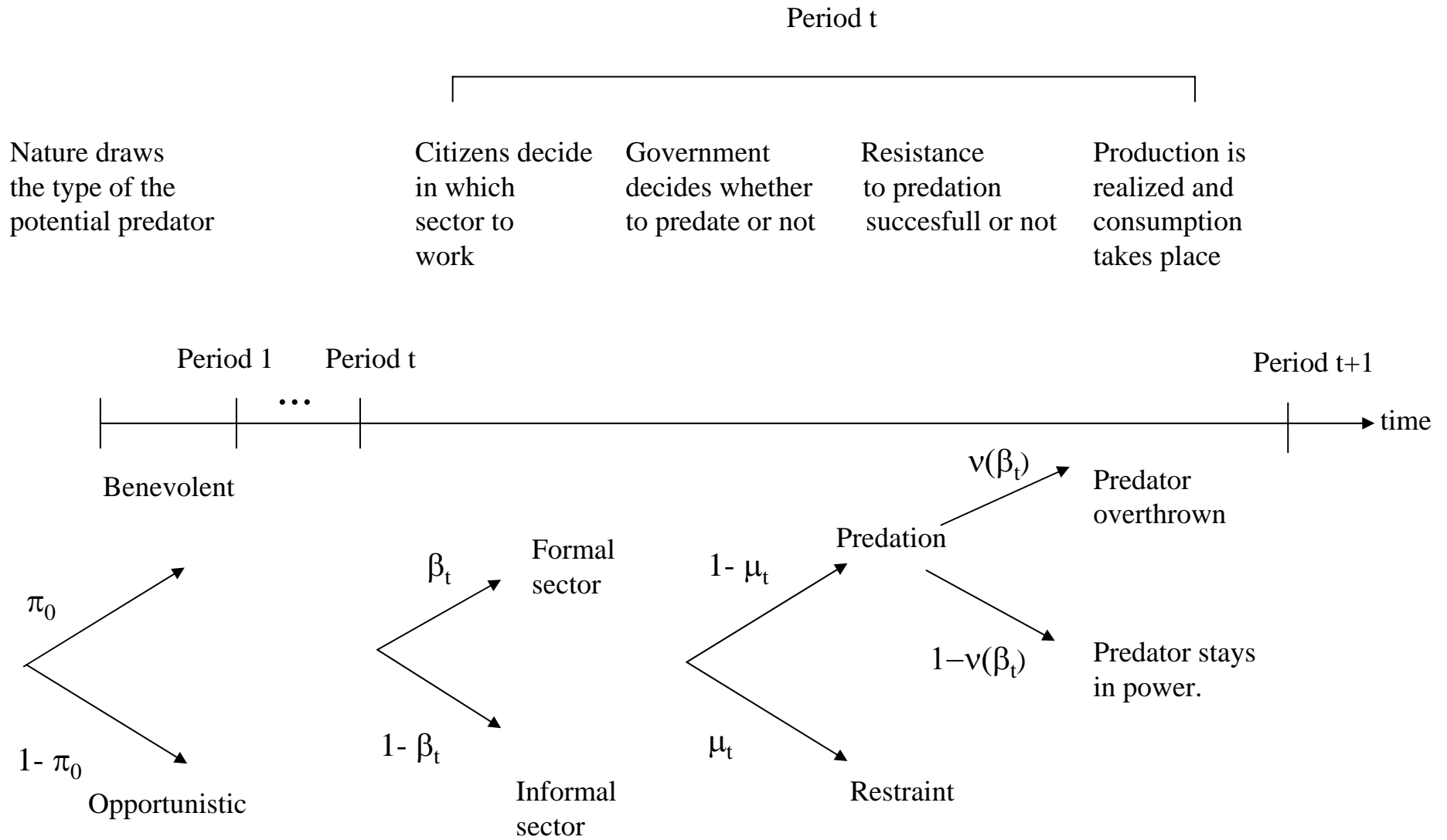


Idi Amin Dada overthrows Obote  
and engages in predation.

Tanzania invades Uganda

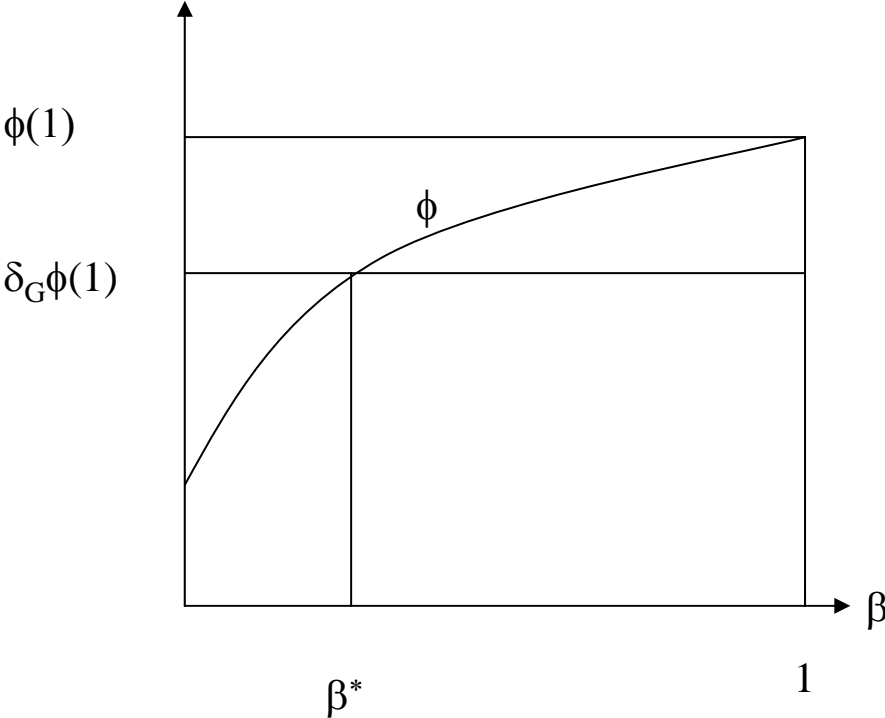
Museveni seizes power  
and refrains from predation

**Figure 2: The sequence of play**

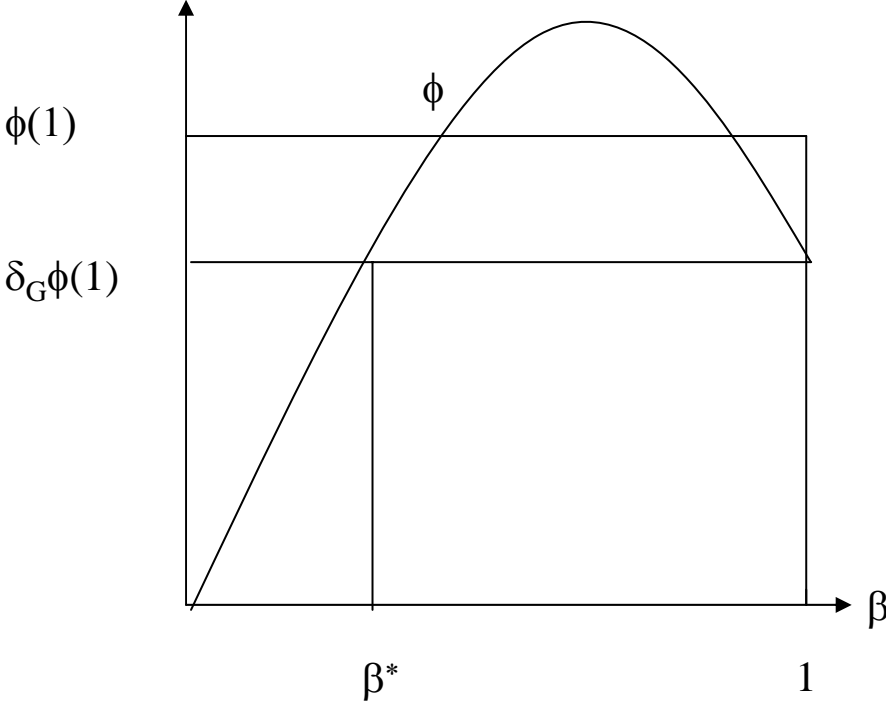


**Figure 3: Expected profits from predation**

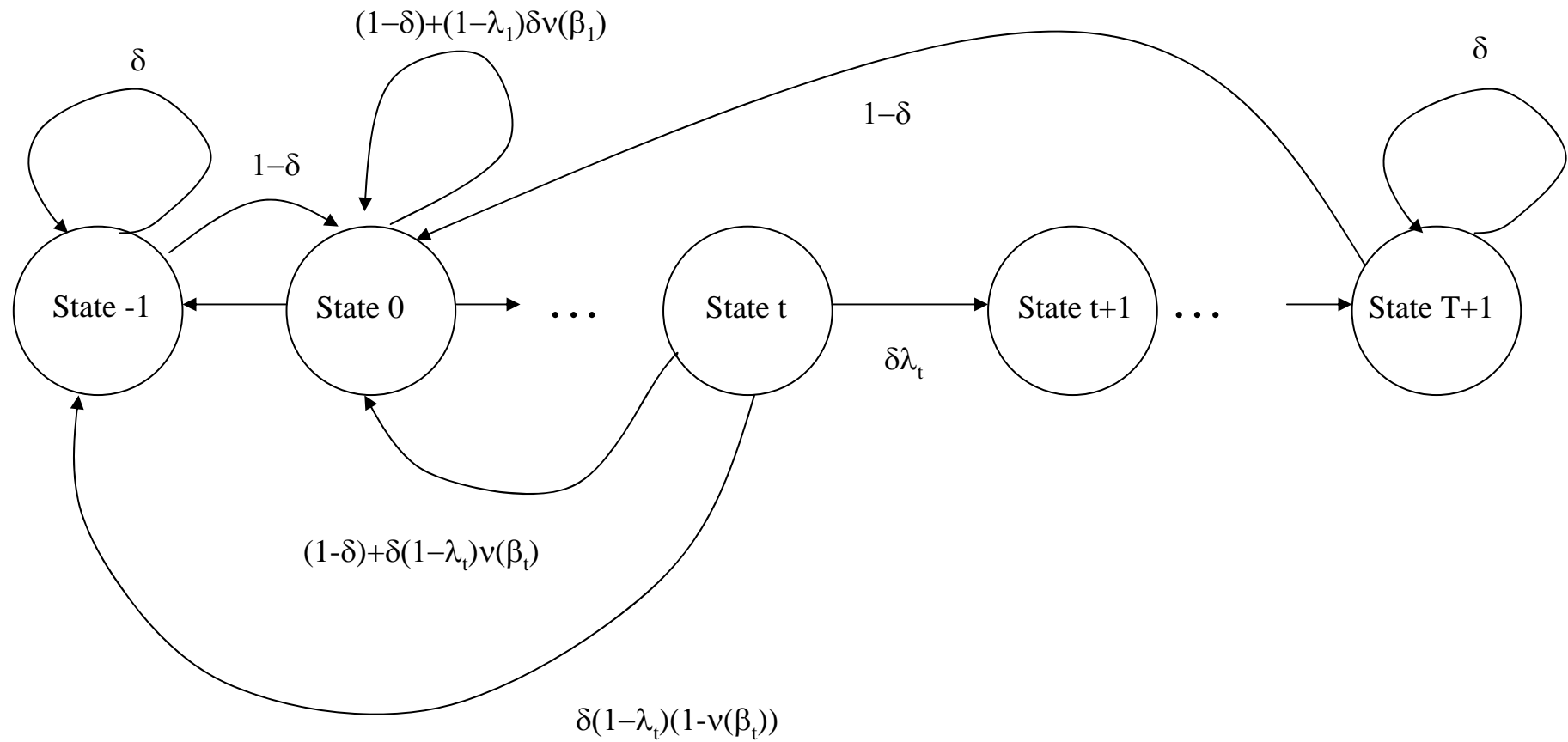
Panel A: Determination of  $b^*$   
when  $\phi$  is increasing over  $[0,1]$



Panel B: Determination of  $b^*$   
when  $\phi$  is not monotonic over  $[0,1]$

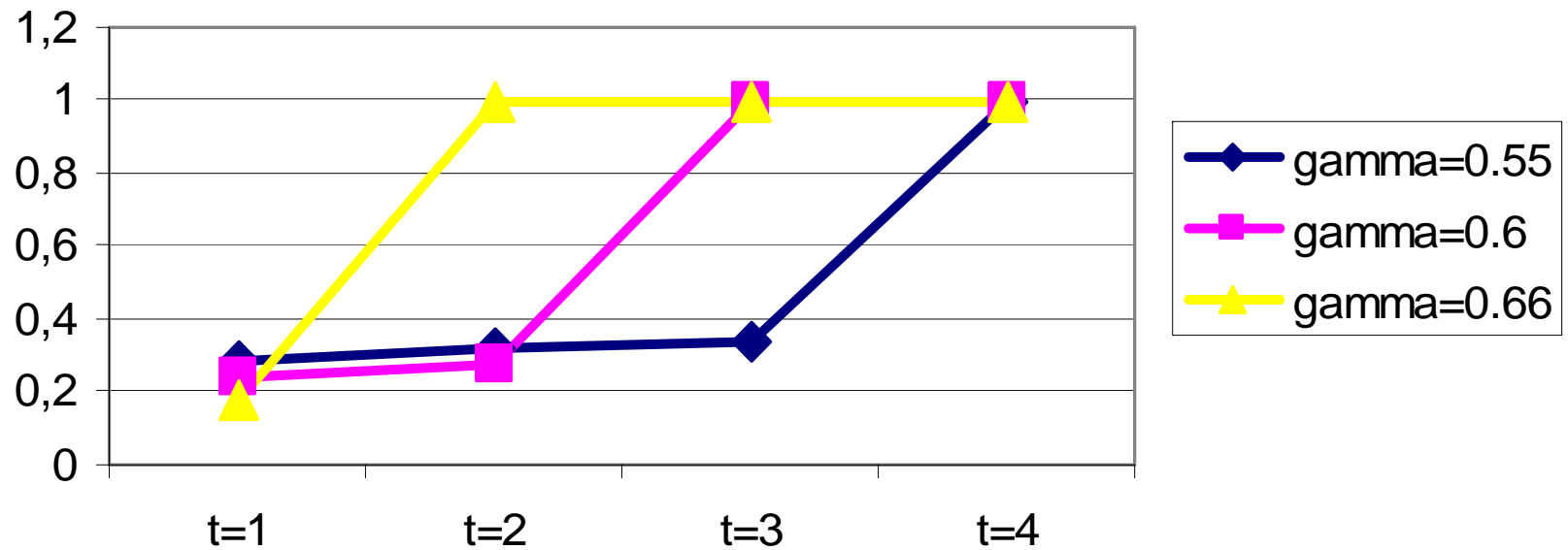


**Figure 4: The Equilibrium Markov Chain**



**Figure 5, Panel A: Probability  $\mu_t$  that the government, if opportunistic, will refrain from predation.**

$\pi_0=.1, \delta_G=.945, \alpha=\eta=.5.$





**Figure 5, Panel B: Fraction  $\beta_t$  of the population operating in the modern sector.  $\pi_0=.1$ ,  $\delta_G=.945$ ,  $\alpha=\eta=.5$ .**

