# Predatory Government and the Informal Sector

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December 2012

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## ABSTRACT

While activities in informal markets are not taxed, the agents engaged in these activities are not protected by the law and order provided by the government. In this paper, we construct a model of government and household behavior to investigate the interaction of the government's strategic choices of the tax burden on the formal sector and the provision of order to the formal sector with the household's strategic choice of resource allocation between formal and informal sectors. Our objective is to explain the large share of the informal sectors and the provision of a low level of public order in most less developed countries regardless of the nature of the ruling government.

We show that even if the public behaves strategically, the predatory government will still tax the economy at a much higher rate and provide a level of order that is much lower than what a democratically elected "good" government would do. Therefore, in a separating equilibrium, even a good government will tax less and

provide a lower level of order. As a result, even under a good government, the informal sector will be large under incomplete information. We show that these results will hold in pooling equilibria too, which will exist if the probability that the government is predatory is small.

**Introduction:**

In this paper, we construct a model of government and household behavior to investigate the interaction of the government's strategic choices of the tax burden on the formal sector and the provision of order to the formal sector with the household's strategic choice of resource allocation between formal and informal sectors. Our objective is to explain the large share of the informal sectors and the provision of a low level of public order in most less developed countries regardless of the nature of the ruling government.

In societies without democracy or in societies with an imperfectly monitored democratic apparatus, governments often transform themselves to graft-seeking agencies pursuing their own self-interests. There is substantial evidence that in such societies, predatory governments tax the formal sector ruthlessly, resulting in "secession" of the citizens to the informal sector. Further, contrary to the claims of Buchanan and Faith (1987), Olson (1990) and others, the predatory government continues to extort the formal sector by increasing the tax burden and/or reducing the supply of order to these societies. This leads to a continuous shrinkage of the formal sector and the emergence of a dominant informal sector induced at least partly by the graft-seeking government. In an older paper, Marcouiller and Young (1993) show that price effects (through changes in the relative price of the goods produced in the two sectors) can be such that the government can always increase the predatory surplus either by raising taxes or by reducing the level of order. Further, they have also shown that if the government harasses the workers in the informal sector, thereby reducing their productivity, it will induce an expansion of the informal sector and reduce its own predatory surplus. In this paper, following the ideas elaborated in Acemoglu and Robinson (2012) we show that even if the public behaves strategically, responding to the government's actions by altering the allocation of resources between the formal and the informal sectors, the predatory government will still tax the economy at a much higher rate and provide a level of order that is much lower than what a democratically elected "good" government will do. A more important issue, not addressed in the Marcouiller and Young (1993) paper, is the observed large size of the informal sector and the low level of public order in societies where the governments are elected democratically. Clearly, if the large size of the informal sector is due to a predatory government, then the size of the informal sector will be large only in countries that are considered to be "not free". Alternately, countries with large informal sectors should have a large tax burden on the formal sector. It can be argued that in countries like India, Indonesia or Colombia, the informal sector is large because in spite of the democratic apparatus, the nature of the government is in fact predatory. However, a more plausible explanation is that the public is not totally confident about the intentions of the government. Thus, the existence of incomplete information about the nature of the government leads to a different kind of equilibrium in the resource allocation game. We demonstrate that even if the probability belief of the public about the government being predatory is small, this changes the behavior of a "good" altruistic government in a separating equilibrium. The good government is unable to adopt the tax rate and the order level that maximizes the net social surplus because a predatory government can mimic the good government and achieve a higher predatory surplus. Therefore, in a separating equilibrium, a good government will tax less than not only the predatory government but also the level that maximizes the net social surplus. On the other hand, the good government will provide a level of order that is lower than its complete information level, although this level will generally be larger than that supported by the predatory government. As a result, even under a good government, the informal sector will be large when there is incomplete information.

Another type of equilibrium that exists in an incomplete information game is a "pooling equilibrium" where both the good government and the predatory government will choose the same tax rate before revealing their nature and choosing different levels of order. We find that such a pooling equilibrium can exist only when the probability that the government is predatory is rather low. As is common in such games, there could be an infinite number of pooling equilibria that can exist here, but we show that for every pooling equilibrium, the level of order provided will be lower and the share of the informal sector will be larger than the corresponding complete information levels even under a good government. The tax rate chosen by the government will be higher than the one chosen by the good government in a separating equilibrium, although it will be usually lower than the predatory tax rate.

The large size of the informal sector and the low level of order that exists in many LDC's can therefore be explained by strategic behavior of the public that is merely unsure of the nature of the government, rather than the existence of a genuine predatory government. Rather surprisingly, an increase in the probability that the government is predatory can be better for the society, because it will shift the economy from a pooling equilibrium to a separating equilibrium where a good government will tax the formal sector at a rate less than the one chosen by both governments in a pooling equilibrium. The intuition behind this result is that an increased suspicion about the government being predatory will make the public respond sharply to a small change in tax rate -- therefore a predatory government will be better off revealing its predatory nature by choosing the predatory tax rate rather than choosing the same rate as the good government.

The paper is organized as follows. In section I, we discuss the complete information equilibrium where the nature of the government is known to the public. In section II, we explain and partly characterize the nature of pooling and separating equilibria under incomplete information. In section III, we show that the complete information equilibria and the separating equilibrium can be completely characterized under specific cost and production functions.

## I. Equilibrium under complete information

The production function of the formal sector is given by $f(x,n)$ where $x$ is the amount of protection and order provided by the government and $n$ is the amount of resources (labor) provided by the households to the formal sector. The production function in the informal sector does not depend on the order provided by the government and is of the form $ß(\underline{n} - n)$ when $\underline{n}$ is the total labor hours available to the households. The level of order provided only to participants in the activities of the formal sector is assumed to have a cost function of $C(x)$ per period.

We will consider a two-stage game where the government chooses a tax rate $t$ ($0 \leq t \leq 1$) in the first stage. In the second stage, the government chooses a level of order and the households simultaneously choose a level of labor they want to devote to the formal sector.

The households know that there are possibly two kinds of governments: good and predatory. The two kinds of governments are identical in every way except their objectives. The good government wants to maximize the net social surplus from the formal sector subject to the constraint that the cost for providing the appropriate level of order to the citizens is at most the amount of real tax revenue obtained from the formal sector. The predatory government, however, wants to maximize its own surplus $tf(x,n) - C(x)$. We will first consider two equilibria where there is complete information about government type.

a. Equilibrium with the good government.

In stage one, the government chooses $t \in [0,1]$ as the tax rate on the product of the formal sector. In stage two, the households (we assume there is one representative household) choose the allocation of total labor $\underline{n}$ between the formal and the informal sectors to maximize their net, after-tax income

$$I = (1-t)f(x,n) + ß(\underline{n} - n) \qquad (1)$$

Here, $f(x,n)$ is a standard neo-classical production function for the formal sector with the following usual assumptions
(we assume an increase in order raises the marginal product of labor in the formal sector):

$$f_n > 0,\ f_x > 0,\ f_{nn} < 0,\ f_{xx} < 0,\ f_{nx} > 0, \text{ and } f_{nx}^2 < f_{nn}.f_{xx} \qquad (1a)$$

We do not assume order is an essential input for our analysis, although all our conclusions will hold when order is essential, or $f(0,n) = 0$.

In (1) above, $ß(\underline{n} -n)$ is the production function of the informal sector. Of course, this production function does not depend on the amount of order provided by the government. We assume $dß/d(\underline{n}-n) > 0$ and $d^2ß/d(\underline{n}-n)^2 < 0$.

The government chooses the level of order x to maximize the net social surplus obtained from the formal sector

$$G = f(x,n) - C(x) \qquad (2)$$

subject to the resource constraint that the cost of providing order must be less than the amount of tax revenue, i.e

$$C(x) \leq tf(x,n) \qquad (3)$$

when C(x) is an increasing, convex cost function of the amount of order provided to the formal sector.

In the second stage, for every tax rate t, the Nash equilibrium of the game is obtained from the two following response functions:

The household's response function is to choose n for every t and x and $n = N(t,x)$ is given implicitly by

$$(1-t)\ \partial f(x,n)/\partial n = d\beta/d(\underline{n} -n) \qquad (5)$$

It can be shown easily that n is an increasing function of x and a decreasing function of t.

The government's response function is to choose x for every n and t. The function $x = X_g(t,n)$ is given implicitly by

$$f_x = (dC/dx) \text{ if } C(x,n) \leq tf(x,n) \qquad (5)$$

$$f_x \geq (dC/dx) \text{ and } t.f_x - (dC/dx) \leq 0 \text{ if } C(x,n) = t.f(x,n) \quad (6)$$

It can be shown that x is an increasing function of both t and n.

A subgame perfect equilibrium for this game is a tax rate $t^*$, a labor allocation $n^*$ and a level of order $x^*$ such that (4),(5) and (6) are satisfied. Since the size of the constraint $tf(x,n) \geq C(x)$ is increasing in t, it is optimal for the government to make the tax level low enough so that at equilibrium

$$t^*f(x^*,n^*) = C(x^*) \text{ and } f_x = (dC/dx) \qquad (7)$$

Given the assumptions of our model we have:

Proposition 1. At a subgame perfect equilibrium of this game, the government provides a level of order that maximizes the net social surplus from the formal sector, and the tax rate is such that the tax revenue exactly equals the cost of providing the optimal amount of order.

Note that the informal sector will continue to exist in this equilibrium. We will see later that this is the situation where the size of the informal sector is the smallest. Simple comparative statics exercises will show the following:

Corollary 1. The size of the informal sector will be larger the higher is cost of providing order to the formal sector, or the smaller is the marginal contribution of order to the productivity of the formal sector.

b. Equilibrium with the predatory government

In this game, the government chooses t in the first stage to maximize

$$V(t) = tf(x,n) - C(x) \qquad (8)$$

In stage two, the household and the government choose n and x respectively. The household's objective function is to maximize, as before,

$$I = (1-t)f(x,n) + ß(\underline{n} - n) \quad (1)$$

Thus for every t, the household's response function is given by n = N(x,t) given by (4) above. The government's response function is given by x = $X_p(t,n)$ which satisfies

$$dC/dx = t.f_x \quad (9)$$

The equilibrium in the second stage is $x_p(t)$ and $n_p(t)$ that satisfy (4) and (9) above for every t. The subgame perfect equilibrium here is $t_p$, $x_p$ and $n_p$ such that x and n satisfy (4) and (9) and the predatory government chooses $t_p$ to maximize its surplus V, i.e

$$\frac{dv}{dt_p} = f(x_p(t_p), n_p(t_p)) + t_p \frac{\partial f(x_p, n_p)}{\partial n} . \frac{dn_p}{dt_p} \quad (10)$$

By concavity of the production functions f and ß and convexity of the cost function C, it can be easily shown that V is a continuous function of t and a maximum $t_p$ exists over the range [0,1]. If there are several maxima, we choose the smallest one.

The "black hole of graft" and the "harassment" results that Marcouiller and Young (1993) obtain will also prevail here under some conditions. However, the intuition behind these results will be more clear when the equilibrium can be completely characterized. Therefore, they are discussed in section III.

One of the two equilibria above will exist only when the household has complete information about the nature of the government. However, in general, even in democratic societies, the public may not have complete faith in the good intentions of the government. Incomplete information will alter substantially the nature of equilibrium here. This is seen in the following section.

## II. Equilibrium under incomplete information.

Let $\alpha$ be the prior probability held by the household that the government is predatory. In this case we have to look for a sequential equilibrium (Kreps and Wilson (1982)) for this two-stage game. The tax rate chosen by the government in stage one will act as a signal to the public who will alter their prior beliefs after observing the tax rate and will choose their labor allocation accordingly. Similarly, the government will take into account the possible effect of its tax rate on the public's belief and consequent choice of the public's labor allocation. Two kinds of equilibria can possibly exist here:

Separating Equilibrium -- The good government and the predatory government choose different tax rates. The public correctly predicts the nature of the government after observing the tax rates. The predatory government is not better off by choosing the tax rate chosen by the good government. The good government can not improve the net social surplus by choosing another tax rate without making it possible for the predatory government to mimic the good government, thereby invalidating the equilibrium.

Formally, a separating equilibrium is a collection of strategies of the public, the good government and the predatory government and beliefs held by the public as follows:

The good government chooses a tax rate $t_g$ in stage 1 and $x_g(t,n)$ in stage 2 given by (5) and (6) above.

The predatory government chooses a tax rate $t_p$ which is different from $t_g$ in stage 1 and a response function $x_p(t,n)$ given by (9) above.

In stage 1, the public identifies the nature of the government fully after observing the tax rate; therefore the public's strategy is $N_s(t)$ given by

$$N_s(t) = n_p(t) \text{ for } t > t_g \qquad (11)$$

$$N_s(t) = n_g(t) \text{ for } t \leq t_g \qquad (12)$$

where $n_p(t)$ is the public's response to the predatory tax rate given by (9) and (4) above and $n_g$ is its response to the good government that satisfies (4), (5) and (6) for every t. In order for these strategies to be a separating equilibrium, they must satisfy the equilibrium conditions for the second stage (which they do by construction). Further, the predatory government will not gain by mimicking the good government's tax rate i.e,

$$t_p.f(x_p(t_p),n_p(t_p)) - C(x_p(t_p)) \geq t_g.f(x_p(t_g),n_g(t_g)) - C(x_p(t_g)) \qquad (13)$$

Pooling Equilibrium -- The good government and the predatory government choose the same tax rate. The public can not infer the nature of the government after observing the tax rate, and hence retains its original prior. Any other strategy of either the good government or the predatory government does not make the player better off, given the equilibrium strategies and the beliefs of the public and the equilibrium strategy of the other type of government.

Formally, note that in a pooling equilibrium, the public will expect the government to follow the predatory policy regarding order with probability $\alpha$ and the good government's policy with probability $(1-\alpha)$. Thus a pooling equilibrium consists of a tax rate $t_L$, a level of order chosen by the good government $x_{gL}$, a level of order chosen by the predatory government $x_{pL}$ and a labor supply to the formal sector $n_L$ such that given the tax rate $t_L$, $n_L$ is the optimal response to the government choosing $x_{pL}$ with probability $\alpha$ and $x_{gL}$ with probability $(1-\alpha)$, i.e.

$$(1-t_L)[\alpha f(x_{pL}, n_L) + (1-\alpha)f(x_{gL}, n_L) + ß(\underline{n} - n_L)] \geq (1-t_L)[\alpha f(x_{pL}, n) + (1-\alpha)f(x_{gL}, n) + ß(\underline{n} - n)] \quad \text{for any } n \leq \underline{n} \qquad (14)$$

Similarly, the order levels chosen by the governments are optimal given $n_L$, therefore

$$t_L f(x_{pL},n_L) - C(x_{pL}) \geq t_L f(x,n_L) - C(x) \quad \text{for any } x \qquad (15)$$

$t_L f(x_{gL}, n_L) \geq C(x_{gL})$, and

$$f(x_{gL}, n_L) - C(x_{gL}) \geq f(x, n_L) - C(x) \text{ for all } x \text{ such that } t_L f(x,n_L) \geq C(x) \quad (16)$$

The other conditions for a pooling equilibrium are that in stage one, the public retains its prior,i.e.

Prob.(the government is predatory | $t_L$) = $\alpha$ (17)

Further, the tax rate $t_L$ is optimal for both types of governments - therefore not only do they maximize their respective surpluses at $t_L$, but also no type of government can gain by choosing the separating strategy. Define the separating equilibrium surpluses for each type of government as $V(t_p)$ and $G(t_g)$ respectively as follows:

$$V(t_p) = t_p\, f(x_p(t_p),n_p(t_p)) - C(x_p(t_p)) \quad (18)$$

$$G(t_g) = f(x_g(t_g),n_g(t_g)) - C(x_g(t_g)) \quad (19)$$

Then, for a pooling equilibrium, the surpluses for each type of government, $V_L$ and $G_L$ respectively will be less than what each can get from a separating equilibrium. Therefore

$$V_L \equiv t_L f(x_{pL}, n_L) - C(x_p) \geq V(t_p) \quad (20)$$

$$G_L \equiv f(x_{gL}, n_L) - C(x_{gL}) \geq G(t_g) \quad (21)$$

when the dependence of x and n on the tax rate have been suppressed in (20) and (21) above.

In general, it is difficult to characterize pooling and separating equilibria unless more specific information about the cost and the production functions are known. We can make the following general remarks:

a. The predatory tax rate $t_p$ can be either larger or smaller than the good tax rate t*. We consider a case in section III where $t^* < t_p$.

b. If the predatory tax rate $t_p$ is greater than t*, and the predatory government gets less than its predatory surplus by mimicking the good government by choosing t*, i.e.

$$t_p f(x_p(t_p),n_p(t_p)) - C(x_p(t_p)) \geq t_g f(x_p(t^*),n_g(t^*)) - C(x_p(t^*)) \quad (22)$$

then the separating equilibrium will have $t_p$ and t* as the tax rates chosen by the predatory and the good governments respectively. In this case, incomplete information has no effect on the behavior of the governments, and the public correctly predicts the nature of the government from its usual behavior.

c. If the inequality in (22) is reversed, then the predatory government will be able to increase its surplus by mimicking the good government. In this case, the separating equilibrium will consist of a tax rate $t_g$ that is different from t*. Therefore, incomplete information about the predatory nature of the government will lead to a substantive change in behavior of the good government. As we will see later, $t_g$ is usually less than t*, but the government will supply a lower level of order than x*, realizing a lower value of net social surplus $G(t_g)$ instead of G(t*).

d. In general, the pooling equilibrium is better for either type of government than the separating equilibrium, because they both realize a higher surplus by (20) and (21) above. The public may be worse off in a pooling equilibrium in an ex-ante sense.

e. The higher the value of n in equilibrium, the lower is the size of the informal sector. If $t^* < t_p$, then $n^* > n_p$, therefore, the size of the informal sector is larger under the predatory government under complete information. However, if $t_g < t^* < t_p$, then with incomplete information the size of the informal sector could be either larger or smaller for the good government than for the predatory government. We show in the next section under what conditions the informal sector is larger under the predatory government in separating equilibrium.

## III. A complete analysis of complete information and separating equilibria

With specific production and cost functions, we describe an economy for which both complete information and separating equilibria are explicitly calculated. In this economy, the total production from both sectors is given by

$$y = x^a n^b + ß.(\underline{n} - n) \qquad (23)$$

The cost of providing order is given by

$$C(x) = x^c \quad (11)$$

We assume:

(i) $0 < a < 1$, $0 < b < 1$

(ii) $a + b \leq 1$ (non-increasing returns) (24)

(ii) $c > 1$ (convex cost function) (25)

The production function for the informal sector is assumed to be linear with ß as the constant marginal product of labor to the informal sector.

A. First, we consider the equilibrium with the good government where the tax rate t*, the labor allocation n* and the effort rate x* are given by the three equilibrium conditions:

As the marginal product of labor will be equal in both formal and informal sectors in equilibrium, we have, from (4)

$$(1-t)b.x^a.n^{b-1} = ß \quad (26)$$

As this equilibrium maximizes the net social surplus from the formal sector, the marginal product of the amount of order provided to the formal sector is equal to the marginal cost of providing such order, i.e.,

$$a.x^{a-1}.n^b = c.x^{c-1} \quad (27)$$

Finally, at this equilibrium, the government satisfies its resource constraint with equality, i.e.,

$$t.x^a.n^b = x^c \quad (28)$$

The solutions to the three equations above are

$$t^* = a/c < 1 \quad (29)$$

$$x^* = \{(a/c)[(c-a)b)/aß]^b\}^{1/[c(1-b)-a]} \quad (30)$$

$$n^* = \{(a/c)^c[(c-a)b)/aß]^{c-a}\}^{1/[c(1-b)-a]} \quad (31)$$

B. Second, we consider the complete information equilibrium with a predatory government. The predatory government chooses $t_p$ and $x_p$ and the public chooses labor allocation $n_p$. In the second stage, the public equates the marginal product of labor from the formal and informal sectors, given x and t as before, giving (26). The government maximizes tf(x,n) - C(x) given n and t with respect to x, which gives the first-order condition

$$ta.x^{a-1}.n^{b} = c.x^{c-1} \quad (32)$$

The solutions to (26) and (32) are

$$x_p(t) = (ta/c)^{[(1-b)/\{c(1-b)-a\}]}.((1-t)b/ß)^{[b/(c(1-b)-a)]} \quad (33)$$

$$n_p(t) = (ta/c)^{[a/\{c(1-b)-a\}]}.((1-t)b/ß)^{[(c-a)/(c(1-b)-a)]} \quad (34)$$

The government maximizes the predatory surplus tf(x,n)-C(x) with respect to t given (33) and (34):

$V(t_p) = \max_t tx^a.n^b - x^c$ subject to (33) and (34).

Therefore, we have, after simplification,

$$t_p = 1-b < 1 \quad (35)$$

and the predatory surplus is

$$V(t_p) = (c-a).[a^a(1-b)^{c(1-b)}.b^{2bc}.c^{-c(1-b)}.ß^{-bc}]^{[1/(c(1-b)-a)]} \quad (36)$$

Comparing the two equilibria, and noting that non-increasing returns to scale imply that $a+b \leq 1$,, we get

Proposition 2. Under complete information,non-increasing returns to scale of the formal sector production function and a convex cost function of providing order to the formal sector, the predatory government charges a higher tax rate than the good government ($t_p > t^*$). Further, the predatory government provides a lower level of order than the good government ($x_p < x^*$). Also, the size of the informal sector is larger under the predatory government as the amount of labor supplied to the formal sector is smaller ($n_p < n^*$) under the predatory government.

Proof: As $a+b \leq 1$, and $c > 1$, $(a/c) < (1-b)$ or $t^* < t_p$. Also, from (30) and (33) with $t_p = 1-b$, we can see that $x^* > x_p(t_p)$ if

$$(1-(a/c))^{b/G} > (1-b)^{((1-b)/G)}.b^{b/G} \quad (37)$$

where $G = c(1-b)-a > 0$. As $(1-(a/c)) > b$ and $1 > 1-b$, (37) is satisfied. The rest of the proposition can be proved using a similar argument.

We can now see the effects of the government harassing the workers in the informal sector. Presumably, as in Marcouiller and Young (1993), this will reduce the marginal product of workers in the informal sector. In our model, this will not change the tax rates of either the good government or the predatory government, but as seen from the equilibrium values above, it will increase the supply of labor to the formal sector, increase the level of order, and will increase the surplus for both the good government and the predatory government. The intuition behind this result is that a reduction in ß will discourage labor supply in the informal sector and will lead to a higher level of order and a larger formal sector under both types of governments.

Another result, named as the "black hole tariff" in Marcouiller and Young (1993), and Magee, Brock and Young (1989), also appears in our equilibria. Clearly, a high tax rate on the formal sector by the predatory government can cause changes in the public's behavior over time, leading to changes in parameters in the future: either a fall in productivity of formal workers (a fall in b), a rise in productivity of the informal sector (a rise in ß), or a fall in productivity of order in the formal sector itself (a fall in a). These can happen if the public becomes more enthusiastic about working in the informal sector, or provides its own informal "law and order" in the informal sector without the help of the government (de Soto (1989)). In either case, as seen from (33) and the fact that $t_p = 1-b$, we can conclude that any of these trends will either keep the predatory tax rate constant or increase it, while the level of order in equilibrium will fall. In the limit, one can have an equilibrium where the tax rate is high and the level of order provided is close to zero. Note that this result is obtained in a Cobb-Douglas production function where order is an "essential" input.

C. We now assume incomplete information about the nature of the government ($\alpha$ is the probability that the government is predatory). Here, a separating equilibrium will not occur with the good government charging t*, if the predatory government can mimic the good government and realize a higher surplus.

If the public believes that $t^* = a/c$ is chosen by the good government, then the predatory government can induce a labor supply of n* (given by (31) above). But given n, it will choose $x_p(t^*,n)$ as given by (33) above to maximize its predatory surplus. This predatory surplus is

$V_p(t^*) = t^*.f(x_p(t^*,n^*),n^*) - C(x_p(t^*,n^*)) =$

$$V_p(a/c)=\left(\frac{a}{c}\right)^{\frac{c^2(1-b)-a^2}{G(c-a)}}.\left(\frac{c-a}{c}\right)^{\frac{c-a}{c(1-b)-a}}.\left(\frac{b}{ß}\right)^{\frac{bc}{c(1-b)-a}} \quad (38)$$

On the other hand, the surplus of the predatory government under complete information is given as (39) below which is obtained from (36) after a little algebra:

$$V(t_p)=(1-b)^{\frac{c(1-b)}{c(1-b)-a)}}.\left(\frac{b^2}{ß}\right)^{\frac{bc}{c(1-b)-a}}.\left(\frac{a}{c}\right)^{\frac{a}{c(1-b)-a}}.\frac{c-a}{c} \quad (39)$$

If (39) is less than (38), then $V_p(t^*) > V(t_p)$ and a separating equilibrium will not occur with the good government choosing t*. During the rest of the section, we will analyze the case where $V_p(t^*) > V(t_p)$.

In the separating equilibrium, <u>the good government chooses $t_g$</u> which is determined as follows. For every t, the good government calculates the level of x and n given by the resource constraint tf(x,n) = C(x) and the maximization of product condition of the household or

$$(1-t)bx^a n^{b-1} = ß \quad (26)$$

$$tx^a n^b = x^c \quad (28)$$

These two equations give the stage-two equilibrium labor supply as a function of t when the public believes that the government is good. This function is

$$n = \{[(1-t)(b/ß)]^{c-a}\ t^a\}^{1/G} \quad (40)$$

If a specific t is chosen by the good government, then the predatory government can choose the same t and realize the maximum value of its predatory surplus by choosing a value of x different from what would be chosen by the good government, knowing that the public will choose n according to (22) above. Let this surplus be defined as $V_p(t)$. If $V_p(t) \geq V(t_p)$ as given by (38), then the predatory government will choose t rather than $t_p$ and this will violate the condition for separating equilibrium. Thus the good government chooses the tax rate $t_g$

such that

$$V_p(t_g) = V(t_p) \quad (41)$$

If (41) is satisfied for several values of $t_g$, we choose the one that gives the highest net social surplus. To find the function $V_p(t)$, notice that if t is chosen by the predatory government and the public chooses n according to (40) above in the second stage, the predatory surplus tf(x,n) - C(x) is

$$tf(x,n) - C(x) = tx^a\{[(1-t)(b/ß)]^{c-a}t^a\}^{b/G} - x^c \quad (42)$$

Clearly, this surplus is maximized when

$$x = [(a/c).\ A]^{1/(c-a)} \quad (43)$$

where

$$A = \{t.[(1-t).b/ßt]^b\}^{(c-a)/G} \quad (44)$$

and the maximized value of the predatory surplus is

$$V_p(t) = (A/c)^{c/(c-a)}.a^{a/(c-a)}.(c-a) \quad (45)$$

From (45) and (41), we find that there will be several values of t for which (41) will be satisfied, Therefore the good government chooses the smallest value of such t as $t_g$ because this will give the maximum net social surplus f(x,n) - C(x) subject to tf(x,n) ≥ C(x).

As the first derivative of $V_p(t)$ is positive at t* = a/c, and we are considering the case where $V(t_p) < V_p(t^*)$, we conclude that $t_g <$ t* and we can also prove

Proposition 3. The good government chooses a tax rate $t_g$ that is lower than t* in a separating equilibrium if the predatory government can mimic the good government's tax rate t* and realize a higher predatory surplus than its complete information predatory surplus. Further, the good government chooses a level of order $x_g(t_g)$ that is less than x*, the labor force in the formal sector in the separating equilibrium $n_g(t_g)$is less than n*, and the size of the informal sector is larger in a separating equilibrium under a good government than under complete information under a good government. Finally, the net social surplus from the formal sector will also be lower under the good government in a separating equilibrium than under complete information.

Proof. We have already shown that $t_g <$ t*. Under $t_g$, the good government's order level and the public's labor supply to the formal sector can be calculated form (26) and (28) above with t = $t_g$

and they are

$$x_g(t_g) = [(1-t)^b.t^{(1-b)}.(b/\beta)^b]^{1/G},\ t= t_g \qquad (46)$$

$$n_g(t_g) = [((1-t)b/\beta)^{(c-a)}.t^a]^{1/G},\ t= t_g \qquad (47)$$

when $G = C(1-b)-a > 0$.

Similarly, under $t^*$, $x^*$ and $n^*$ can be calculated from (26) and (28) as

$$x^* = [(1-t^*)^b.t^{*(1-b)}.(b/\beta)^b]^{1/G}, \qquad (48)$$

$$n^* = [((1-t^*)b/\beta)^{(c-a)}.t^{*a}]^{1/G}, \qquad (49)$$

Comparing (46) and (48), we see that $x_g(t_g) < x^*$ if (as $G > 0$)

$$(1-t_g)^b.t_g^{1-b} < (1-t^*)^b.t^{*1-b} \qquad (50)$$

As the expression $(1-t)^b.t^{(1-b)}$ reaches its maximum at $t=(1-b)$, and is increasing in $t$ for $t < 1-b$, and as $t_g < t^* < t_p = 1-b$, (50) is satisfied.

Similarly, comparing (47) and (49) $n_g(t_g) < n^*$ if

$$(1-t_g)^{c-a}.t_g^a < (1-t^*)^{c-a}.t^{*a} \qquad (51)$$

As the expression $(1-t)^{c-a}.t^a$ reaches its maximum at $t^* = a/c$, is increasing in $t$ for $t < a/c$, and as $t_g < t^* = a/c$, (51) is satisfied.

As $n$ is lower under $t_g$, the informal sector labor supply $\underline{n} - n$ is higher under $t_g$ and the informal sector is greater under the separating equilibrium.

We can also prove that the net social surplus $G = f(x,n) - C(x)$ is smaller at $t_g$ than at $t^*$ using the same argument.

## Concluding Remarks

This paper has attempted to construct a theoretical basis for “Why Nations Fail” (Acemaglu and Robinson (2012)), by constructing an explicit strategic model of the government and the public. An interesting observation that emerges is that when the separating equilibrium prevails, the good government has to modify its behavior in order to reveal itself fully to the public, but the predatory government can continue to choose its predatory tax rate in either a complete information equilibrium or a separating equilibrium. This feature, which is present in many other separating equilibrium strategies of "good" players when the other player is "crazy", can be explained clearly if we start hypothetically from a tax rate of

1/3 with the good government. Now, suppose that the public suspects with probability $\alpha > 0$, that the government is actually predatory. Then according to the reasoning given above, the public will calculate that if the government were predatory and a tax rate of 1/3 were chosen, then the predatory government will realize a surplus of $V_p(1/3) = .3849$ which is greater than the predatory government's surplus when it reveals itself (.1054588). Therefore, if there is a predatory government with probability $\alpha > 0$, then that government will choose a tax of 1/3. This destroys the optimality of public's choice of n* = 9. Therefore the good government can not choose a tax rate of 1/3 in a separating equilibrium.

Even if the question of which equilibria actually occurs remains unanswered here, we can clearly see that the size of the informal sector is larger in all incomplete information equilibria than under the complete information equilibrium with a good government. Under a predatory government, the informal sector will be even larger. Further, the level of order is lower under all incomplete information equilibria under good government. However, the tax rate of the good government can be either higher or lower under incomplete information than t*, the rate under complete information.

While this paper provides a behavioral model for government behavior in possibly corrupt countries, there are obvious limitations of this analysis. We have ignored relative price-effects altogether in our simple model, both on the output side and on the input side through changes in the price of other resources. Further, there could be a steady group of formal sector producers in the economy who, by nature of their enterprise, have no option of working outside the formal sector. As these agents will behave differently, the predatory government will have a stronger incentive to tax the formal sector at an even higher rate. More importantly, in a repeated game of the kind considered here, there could be either more congenial behavior on the part of both the predatory and the good government, leading to a smaller informal sector and provision of a higher level of public order; or more paranoid behavior on the part of the public, leading to a larger informal sector. Finally, this model completely ignores the allocation of capital investment decisions between the formal and informal sectors. These decisions, which may also be taken strategically in response to the government's tax policy and provision of public order, will influence the evolution of the formal and informal sectors over time in many less developed countries.

**References**

Acemoglu, Daron and Robinson, James (2012), *Why Nations Fail: Origins of Power, Poverty and Prosperity,* Crown Publishers (Random House).

Buchanan, J. and R. Faith, (1987) "Secession and the Limits of Taxation: Toward a Theory of Internal Exit" *American Economic Review*. December, *77*, 1023-31.

Chickering, A. and M. Salahdine (eds.) (1991), *The Silent Revolution: The Informal Sector in Five Asian and Near Eastern Countries*. ICS Press: San Francisco.

Clark, G. (ed.) (1988), *Traders vs. the State: Anthropological Approaches to Unofficial Economies*. Westview Press: Boulder, CO.

De Soto, H.(1989), *The Other Path.* Harper and Row: New York.

Gastril, R.D. (1988), *Freedom in the World: Political Rights and Civil Liberties.*Freedom House: New York.

Kerner, D. (1988), " "Hard Work" and Informal Sector Trade in Tanzania" in G. Clark (ed.), *Traders vs. the State: Anthropological Approaches to Unofficial Economies*. Westview Press: Boulder, CO.

Kreps , D. and R. Wilson (1982), "Sequential Equilibria" *Econometrica, 50*, 863-894.

Magee, S., W. Brock and L. Young (1989), *Black Hole Tariffs and Endogenous Distribution Theory*. Cambridge University Press: Cambridge.

Marcouiller, D. and L. Young (1993),"The Black Hole of Graft: The Predatory State and the Informal Economy". Mimeo.The University of Texas at Austin.

Olson, M. (1991), "Autocracy, Democracy and Prosperity," in *Strategy and Choice,* edited by R. Zeckhauser. Cambridge, MA: The MIT Press.

Poapongsakorn, N.(1991),"The Informal Sector in Thailand," in Chickering, A. and M. Salahdine (eds.), *The Silent Revolution: The Informal Sector in Five Asian and Near Eastern Countries*. ICS Press: San Francisco.

Salahdine, N. (1991),"The Informal Sector in Morocco: The Failure of Legal Systems?" in Chickering, A. and M. Salahdine (eds.) *The Silent Revolution: The Informal Sector in Five Asian and Near Eastern Countries*.ICS Press: San Francisco.

Sanderatne, N.(1991), "The informal sector in Sri Lanka: Dynamism and Resilience", in Chickering, A. and M. Salahdine (eds.), *The Silent Revolution: The Informal Sector in Five Asian and Near Eastern Countries*.ICS Press: San Francisco.