Investment in the absence of property rights; the role of incumbency advantages

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Abstract

In many situations the individuals who can generate some output must enter a contest for appropriating this output. This paper analyses the investment incentives of such agents and the role of incumbency advantages in the contest. Depending on the advantages, an increase in the productivity of the investment can decrease or increase the amount of investment. The results are applied to autocrats' investment behavior and job specific investment in organizations.

Keywords: investment, endogenous property rights, contests, incumbency advantage, proprietary states.

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1 Introduction

Agents who have an investment opportunity face a hold-up problem if they cannot be sure to appropriate the returns on their investment. This is a well known problem.[1] In this paper a related, and possibly more serious problem is considered. In the absence of property rights, agents will typically enter contests in which they compete with rivals and spend resources in order to improve their own chances of appropriating these returns. Accordingly, if the investment is large and it generates a large return, the agent will also spend more resources in the contest in which he tries to appropriate this return. These conflict costs constitute a welfare loss. Further, they reduce the expected net payoff from investing, making investment also less attractive.

The idea that appropriation costs are a major source of welfare losses has been discussed in the context of lobbying and rent-seeking. Originating with Tullock (1980), there has been much work which considers the properties of appropriation contests. For a survey see Nitzan (1994). More recently, the implications of appropriation contests for strategic behavior have also been considered. For instance, comparative productivity advantage matters in conflicts (Skaperdas, 1992), future conflict may change today's incentives to trade with future rivals (Skaperdas, 1998), and future conflict may affect current production and current contest activities (Garfinkel and Skaperdas, 2000) and the incentives to form alliances (Skaperdas and Syropoulos, 2001).

This paper considers a related strategic issue. An agent who knows he will participate in a contest for some prize in the future considers spending resources by which the agent can increase the size of the prize. As the size of the prize is observed and affects rivals' contest effort, there is a strategic effect – lower investment reduces the rival's contest effort. The paper particularly considers the role of incumbency advantages for investment. The investment disincentives from the contest are more substantial if the contest advantage of the investor is small, and can be prohibitive if the agent has no advantage in the contest. Two types of advantage are distinguished. The agent may win without any effort even if his rival expends effort up to some critical effort level. This advantage will be called a headstart advantage. In addition, the incumbent may be more efficient in the contest and generate the same increase in win probability in the contest with a smaller increase in his contest effort. We call this a productivity advantage. The comparative statics are surprising. For instance, an increase in the productivity of investment, or in the share of the investment that can be appropriated by the winner of

[1] See, for instance, Eaton and Gersovitz (1983) and Schnitzer (1995) in the context of foreign direct investment, and Konrad, Olsen and Schöb (1994) on investment in natural resource extraction under exogenous expropriation threats.

the contest, may reduce the equilibrium amount invested. As a corollary, an increase in the share of investment returns that goes to neither the investor nor his rival but, for instance, to a third party, may increase investment.

Two applications are discussed. First, the paper can contribute to explaining the investment behavior in 'proprietary states', that is, states ruled by dictators who extract revenue from the country and try to maximize the present value of this revenue. Olson (1993) and McGuire and Olson (1996), for instance, compare a dictator to an entrepreneur and consider the country as the dictator's firm. They analyze the dictator's incentives to invest in public infrastructure or education, whereby he maximizes the discounted present value of tax revenues (his profit) that he can collect. If the dictator provides an additional unit of public input, this increases the output he can draw on in the future. Indeed, many countries seem to be run by this type of dictator,[2] but their investment behavior is very different.[3] Note that such dictators also have to fight to stay in power (Grossman, 1999). For instance, the frequent conflicts and civil wars in dictatorial states (see, e.g. Collier, 2001, for data sources and an analysis), suggest that this is a major concern for dictators.[4] We will confront the theory outcomes with some piecemeal evidence on proprietary states later.[5]

[2]Many dicators spent decades in office and ruled their countries like farms or enterprises, but did not invest. Examples are Rafael Trujillo who was in office from 1930 to 1961 in Dominican Republic, the Somoza family [1937-1979] in Nicaragua, Ferdinand Marcos [1965-1986] in Phillipines, the Duvaliers [1957-1981] in Haiti, or Mobutu [1965-1997] in Zaire, all of whom basically extracted revenue, accumulated private wealth, and disinvested in public infrastructure. For a survey and discussion, see for example Robinson (1999).

[3]Even among countries with seemingly similar structures of dictatorial governance, some countries do very well and other countries do not. For instance, during the last decades some dictatorships in Southeast Asia had excellent economic performances, whereas other dictatorships, particularly in Africa, became poorer (e.g., Collins and Bothworth, 1996, Easterly and Levine, 1997). Alesina and Perotti (1994, p. 353) also report that dictatorships' performance is far from homogenous.

[4]Skaperdas (2001) and Konrad and Skaperdas (1999) develop a theory of endogenous property rights and property rights protection agencies. Conflict for governance turns out to be a major source of welfare losses.

[5]A related literature on economic performance or growth has considered security of property rights of private investors and common pool problems between groups that compete for redistribution. For some examples, further references and related ideas see, e.g., Besley (1995), Easterly and Levine (1997), Persson and Tabellini (1994), Persson, Roland and Tabellini (1997), and Tornell and Lane (1999). Insecure private property rights and private rent seeking activities have similar effects on private actions (e.g., low savings, or capital flight). It is likely that both types of property rights issues contribute to explaining poor economic performance. They are not mutually exclusive and may often complement each other. Indeed, a dictator's insecure property rights may induce policies (e.g., possible expropriation, or extortionary taxation) that create uncertainty and insecure property

A second application is on organizations. Consider a manager who has to decide how much effort to invest in (re)-organizing the unit which is under his supervision, in an environment with incomplete contracts. If a manager spends much effort today, the efficiency of his unit may improve. The manager bears the investment cost of his time and effort. The benefits accrue to the person who manages this unit in the future: if the unit operates more efficiently, the manager's job is usually easier. Particularly if these efforts and their results are observable but not verifiable,[6] the manager's job will be more attractive for rival candidates if the manager expends a lot of effort. Hence, a manager who has invested a lot may have to expend more resources on influence activities[7] in trying to fend off rival managers who may lobby for appropriating these gains. We will briefly consider the implications of this effect for firm profitability and CEO turnover.

We proceed as follows. Section 2 presents the model and explains how it relates to the decision problems of dictators in proprietary states and managers in organizations. Section 3 solves for the equilibrium. Section 4 discusses comparative statics. Section 5 relates these equilibrium results to some observations about proprietary states and organizations. Section 6 discusses robustness and extensions, and section 7 concludes.

2 Investment and contests for power

To address these issues more formally, the following two-period framework is considered.[8] In period 1 an agent is in charge of making an investment decision in this period. This agent is called the *period*-1 *incumbent*. He chooses investment k and this investment is a cost for the incumbent. This investment pays off in period 2, and the total output generated is a function $y = f(k)$. This function has standard properties of a production function; $f(k)$ is twice continuously differentiable with positive and decreasing marginal productivity. The incumbent in period 2 appropriates some share $0 \leq T(y) \leq y$ of this output. Here, the appropriation function T is assumed to be (weakly) increasing in y, and (weakly) concave. It will be convenient to define the

rights for the private sector.

[6]The problem disappears if the manager and his superior can write a contract that specifies the amount and type of investment, and who receives the returns on the investment.

[7]For a formal contest set-up of influence activities, see Ellingsen (1997).

[8]The analysis here can be generalized to an infinite time horizon model and the results carry over to Markov perfect equilibria in such a set-up.

amount of returns that can be appropriated as

$$B(k) \equiv T(f(k)), \tag{1}$$

with $B'(k) > 0$, $B''(k) < 0$. In order to concentrate on interior solutions, we make the following assumptions: $B(0) = 0$, $\lim_{k\to 0} B'(k) = \infty$, and $\lim_{k\to\infty} B'(k) = 0$.

The incumbent in period 1 is not necessarily the incumbent in period 2. At the end of period 1 an agent ("she", called the *rival*) shows up. The rival has an opportunity to challenge the period-1 incumbent in a contest. Whether the period-1 incumbent or the rival will earn the returns $B(k)$ in period 2 depends on the contest efforts of the period-1 incumbent and the rival. We analyze how the properties of the function $B(k)$ and the properties of the contest determine the investment behavior.

The contest for incumbency in period 2 that takes place at the end of period 1 is described as follows. The incumbent and the rival spend contest efforts w and $\bar{w}$, respectively. A contest success function

$$q(w, \bar{w}) = \left\{ \begin{array}{c} 1 \\ 1/2 \\ 0 \end{array} \right\} if \left\{ \begin{array}{l} w > b\bar{w} - a \\ w = b\bar{w} - a \\ w < b\bar{w} - a \end{array} \right\} \tag{2}$$

determines the incumbent's win probability as a function of contest efforts. The incumbent wins if $w > b\bar{w} - a$. He loses if $w < b\bar{w} - a$, and a coin is tossed to determine who wins in the case of a tie. The rival wins with probability $1 - q(w, \bar{w})$.

If $b = 1$ and $a = 0$ in (2), the contest is perfectly symmetric. However, incumbents may often have incumbency advantages. The contest success function (2) allows for two types of such advantages. If, for instance, $b = 1$ and $a > 0$, there is a situation in which the incumbent has some *headstart advantage*. He wins even if he spends a units of contest effort less than the rival. A second type of incumbency advantage is described by the parameter b. It measures a relative *effectiveness advantage* of the incumbent's effort. If, for instance, $b < 1$ and $a = 0$, the incumbent needs only $w = b\bar{w}$ units of effort to match the effect of his rival's effort $\bar{w}$. The two types of incumbency advantage may exist simultaneously. Throughout, we assume that the incumbent has some an incumbency advantage, or at least no disadvantage: $b \in (0, 1]$ and $a \geq 0$.

Contest success functions as in (2) are frequently used.[9] The results in this paper are derived for this contest success function. As will be discussed

[9] Variants of this contest success function are used to describe contests in various fields ranging from law and economics, R&D, lobbying, advertizing and sales contests, litigation,

in section 4, the results qualitatively generalize to contest success functions for which the winning probability is a continuous function of contest efforts.

The incumbent in period 1 maximizes the expected discounted sum of net revenue. His payoff Ω can be written as

$$\Omega = -k - w + q(w, \bar{w})B(k). \tag{3}$$

He spends resources $k \geq 0$ on investment and then chooses his contest effort $w \geq 0$. He wins the contest with probability $q(w, \bar{w})$, in which case he obtains $B(k)$ in period 2.

The rival's payoff function is given by

$$\Phi = -\bar{w} + (1 - q(w, \bar{w}))B(k). \tag{4}$$

The rival also spends contest effort $\bar{w} \geq 0$ at the end of period 1, simultaneously with the incumbent. The rival wins with probability $1 - q(w, \bar{w})$ and, in this case, becomes the incumbent in period 2 who obtains the period-2 payoff $B(k)$. In order to economize on notation, we assumed for (3) and (4) that the discount factors of both the period-1 incumbent and his rival are equal to 1.

The timing of the game can be summarized as follows. In period 1 the incumbent decides about investment k. This choice becomes observable. Now the incumbent and an entrant simultaneously choose their contest efforts.[10] In period 2 the investment pays off and $B(k)$ is received by the agent who is the incumbent in period 2.

Before describing the equilibrium, we consider how the set-up fits with proprietary states or manager's decisions to invest effort. In the proprietary state, k is what the ruler refrains from appropriating today[11] in order to generate output $f(k)$ tomorrow, with $B(k)$ the amount of this output that

and lotteries, to political campaigns. See, e.g., Hirshleifer and Riley (1992), Ellingsen (1991), and Baye, Kovenock and deVries (1998) for examples and further references. See also section 6 for a discussion.

[10]The incumbent is not cash constrained as regards his expenditure for investment or for contest effort, and it will be assumed that the rival also does not have an upper limit of effort that may become binding in the equilibrium. This will be discussed in section 4.

[11]This public investment can be defined narrowly as public education, or public infrastructure investment, or can include the abstinence from short sighted policies such as loose monetary policy that leads to some immediate seigniorage but has inflation costs in the medium and long run, protectionist trade policy that generates some immediate revenue from tariffs and licenses but distorts the economy and slows down growth, or the ruler may excessively tax domestic or foreign investors, a policy that also yields some immediate revenue but destroys trust and credibility and leads to capital flight or deters future foreign direct investment.

will be appropriated by the period-2 ruler.[12] The contest is between the ruler and some opposition. Rivals could be rulers of neighboring countries who think about military conquest, or rival elites or power groups within the country. The nature of the incumbency advantage depends on the type of conflict. The contest could be an election. For elections, incumbency advantages are well documented (see, e.g., Mueller, 1989, p.185 for a survey). For military conflict or civil war, the incumbency advantage measures how much easier it is to defend than to attack. Incumbency advantages of a ruler may also be rooted in history or culture. For instance, leadership in former secession or independence wars, monarchy, or religious leadership may provide such advantages.

If the incumbent is a manager, the investment k can best be seen as time and other opportunity cost which the manager invests in making his unit more efficient. $B(k)$ then is the additional rent which the manager who runs this unit in period 2 receives from the fact that the efficiency of the unit has been increased. Outsiders (possibly from within the firm, possibly from outside the firm) may contest with the manager for taking over this manager's position, or for appropriating the gains from his effort in some other way, for instance, by restructuring the firm, or by relocating tasks and responsibilities within the firm.[13]

3 Investment in the equilibrium

The contest considered is a generalization of the first-price all-pay auction that has been analyzed by Hillman and Riley (1989) and Baye, Kovenock and deVries (1996). The equilibrium for a prize of given size $B(k)$ is described as

Lemma 1 *For a given prize of size B, if the contestants can make simultaneous effort choices $w \geq 0$ and $\bar{w} \geq 0$, the contest equilibrium with contest success function (2) is given as follows:*
(i) If $B > \frac{a}{b}$ there is no equilibrium in pure strategies. The (unique) mixed strategy equilibrium is characterized by probability distribution functions $F(w)$ and $\bar{F}(\bar{w})$ for the incumbent's and the rival's contest efforts $w \geq 0$ and $\bar{w} \geq 0$, respectively, with

$$F(w) = \begin{cases} \frac{a}{bB} + \frac{1}{bB}w & \text{for} \quad w \in [0, bB - a] \\ 1 & \text{for} \quad w > bB - a \end{cases} \tag{5}$$

[12] More explicit models of predatory states providing some microfoundation for this function $B(k)$ include Acemoglu and Robinson (2000), Konrad and Skaperdas (1999) and Moselle and Pollak (2001).

[13] Such contest activities are discussed as influence activities, e.g., in Milgrom (1988), and explicitly modeled as a contest in Ellingsen (1997).

and

$$\bar{F}(\bar{w}) = \begin{cases} 1 - b + \frac{a}{B} & \text{for} \quad \bar{w} \in [0, \frac{a}{b}) \\ 1 - b + \frac{b}{B}\bar{w} & \text{for} \quad \bar{w} \in [\frac{a}{b}, B) \\ 1 & \text{for} \quad \bar{w} > B \end{cases} \tag{6}$$

(ii) The unique equilibrium in a contest for a prize $0 \leq B \leq \frac{a}{b}$ *is* $w = \bar{w} = 0$.

A proof is relegated to the Appendix. To make this outcome intuitively plausible, note first that, for $B > \frac{a}{b} \geq 0$, a pure strategy equilibrium cannot exist. Suppose $(w, \bar{w})$ is a pure strategy equilibrium. Suppose $w = 0$ in this equilibrium. Then the rival would choose some $\bar{w} = a/b + \varepsilon$, just enough to win the contest. But $w = 0$ is not an optimal answer to this $\bar{w}$. Suppose that $w > 0$. The rival's optimal response to this w is either $\bar{w}(w) = 0$, or $\bar{w}(w) = \frac{w}{b} + \frac{a}{b} + \varepsilon$ for some arbitrarily small positive ε. But then this $w > 0$ is not an optimal response to $\bar{w}(w) = 0$, nor to $\bar{w}(w) = \frac{w}{b} + \frac{a}{b} + \varepsilon$. This shows that $(w, \bar{w})$ cannot be an equilibrium. Second, consider the properties of the mixed strategy equilibrium. Note that no contestant will spend effort that exceeds his or her valuation of the prize. The rival will not spend more than B. Given that the rival will not spend more than B, the incumbent's effort should not exceed $(bB - a)$ by a strictly positive amount, because $(bB - a)$ would be sufficient to make his win probability equal to 1. This limits the possible equilibrium efforts from above. The incumbent chooses zero effort with strictly positive probability mass $\frac{a}{bB}$. Given a positive headstart advantage $(a > 0)$, the incumbent wins in this case with probability $(1 - b + \frac{a}{B})$. The rival, who has payoff equal to zero in the equilibrium, chooses zero effort with positive probability mass $(1 - b + \frac{a}{B})$. She loses in this case with probability one. Further, it is not reasonable for the rival to spend effort $\bar{w} \in (0, \frac{a}{b})$: the rival loses with probability one if she chooses effort from this interval, even if the incumbent spends zero effort, and hence, the rival's effort would be purely wasted. Finally, note that the probability density must be uniformly distributed in the interval $(0, bB - a)$ for the incumbent and in the interval $[\frac{a}{b}, B)$ for the rival. For instance, for the incumbent, this can be seen as follows. It must hold that the incumbent is indifferent whether he increases his effort marginally or not, for all effort choices from this interval. The cost of an additional marginal unit of effort is 1. The benefit of this marginal unit is the incumbent's valuation B of winning, times the increase in the probability of winning the contest. This additional probability is equal to $\bar{F}'(\bar{w})\frac{1}{b}$. Accordingly, equalization of marginal cost and marginal benefit requires $\bar{F}'(\bar{w}) = b/B$. Similar reasoning applies to the rival entrant and requires uniform distribution of the incumbent's effort on the interval $(0, bB - a)$.

Lemma 2 *For a given prize of size $B > 0$ and contest success function (2), if the contestants make simultaneous effort choices $w \geq 0$ and $\bar{w} \geq 0$, the equilibrium payoff for the incumbent is $(1-b)B + a$ if $B(k) > \frac{a}{b}$ and equal to B if $B \leq \frac{a}{b}$. The rival entrant always has an equilibrium payoff equal to zero.*

Lemma 2 can be confirmed using any effort from the equilibrium support in (5) and (6) to calculate the equilibrium payoffs for the case $B > \frac{a}{b}$ and using $w = \bar{w} = 0$ for the case $B \leq \frac{a}{b}$. The payoff for the rival is always zero. The incumbent's payoff equals $(1-b)B + a$, or B, depending on whether a contest takes place.

Consider now the incumbent's incentive to invest in period 1. By lemma 2, if and only if the incumbent invests not more than a threshold level K given by

$$B(K) = a/b, \tag{7}$$

then the prize is small enough in relation to the headstart advantage so that no contest occurs. Also by lemma 2, the incumbent's overall expected payoff as a function of k is given by

$$\Omega(k) = \begin{cases} -k + B(k) & \text{for} \quad k < K \\ -k + (1-b)B(k) + a & \text{for} \quad k \geq K \end{cases}. \tag{8}$$

Notice that this payoff is continuous in k. Let k^s (with s for 'security') be defined by

$$B'(k^s) = 1. \tag{9}$$

This is the amount the incumbent would choose to invest if he knew that there would be no contest next period. Thus, if $k^s \leq K$, then this is what the incumbent invests and the equilibrium involves no contest. Let k^c (with c for 'conflict') be defined by

$$(1-b)B'(k^c) = 1. \tag{10}$$

This is the amount the incumbent would choose to invest if he knew that there would be a contest next period such that his marginal benefit from investment is deflated by $(1-b)$. Since $B' > 0 > B''$, we have $k^c < k^s$ for all b in $(0,1)$. Thus, if $K < k^c < k^s$, the incumbent chooses k^c, and a conflict ensues with effort functions given by (5) and (6). Finally, if $k^c < K < k^s$, the incumbent chooses K; that is, the incumbent does better to invest just small enough to ensure no conflict than to invest such that a conflict ensues.

Figure 1 illustrates the three cases. The two downward sloping curves are $B'(k)$ and $(1-b)B'(k)$. K is determined where $B(K) = \int_0^K B'(k)dk = a/b$. In case (i) the opportunity cost curve (parallel line to the $k-$axis at unity)

intersects $B'(k)$ to the left of K and the intersection determines k^s. In cases (ii) and (iii) the opportunity cost curve intersects $B'(k)$ to the right of K. Accordingly, the choice of investment k^s would lead to a contest, making the marginal investment at k^s not worthwhile. The incumbent chooses k^c if the marginal benefit of investment at K exceeds unity, that is, if $(1-b)B'(K) > 1$. This is case (iii). Finally, Figure 1 illustrates the case (ii) with $B'(K) > 1 > (1-b)B'(K)$.

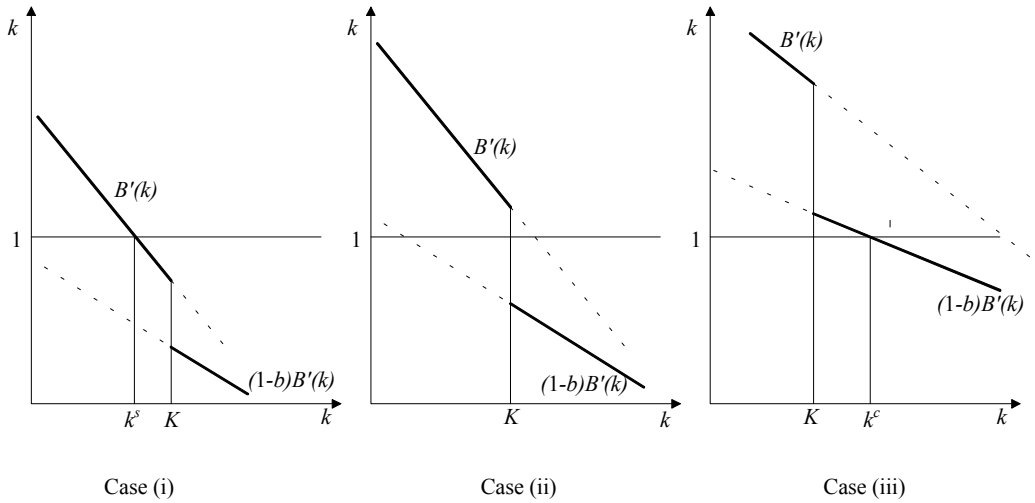

Figure 1

These considerations are summarized as a proposition:

Proposition 1 *The (unique) subgame perfect equilibrium is characterized as follows.*
(i) If $K > k^s$, then the equilibrium amount of investment is k^s. Equilibrium contest efforts are $w = \bar{w} = 0$.
(ii) If $k^s > K > k^c$, then the equilibrium amount of investment is K. Equilibrium contest efforts are $w = \bar{w} = 0$.
(iii) If $k^c > K$, then the equilibrium investment is k^c, and equilibrium contest effort distributions are F and $\bar{F}$ as described by (5) and (6).

The welfare loss in these equilibria compared to a situation in which there is no contest, and in which the incumbent can be sure to earn $B(k)$ of the return on the investment is two-fold. First, there is a reduction in investment compared to k^s in cases (ii) and (iii). This reduction in investment is a distortion and generates a welfare loss. This welfare loss is particularly large

if the investment is already distorted at k^s, that is, if $B'(k) < f'(k)$. Further, if there is a contest, as in case (iii), the expected effort which the incumbent and the rival spend in this appropriation contest is an additional welfare loss, equal to the sum of contest efforts, i.e., equal to $bB(k) - a$.

4 Properties of the equilibrium

The equilibria characterized in Proposition 1 have several interesting comparative static properties. We consider productivity changes and the relationship between an incumbent's probability for staying in office, the type of incumbency advantages, and investment incentives.

Productivity shifts. Consider a small shift of the function $B(k)$ to some $\tilde{B}(k)$ with $\tilde{B}'(k) > B'(k)$ for all $k \geq 0$. This change may be induced by an increase in the genuine productivity of the investment, an exogenous appreciation of assets controlled by the period-2 incumbent, or by an increase in the share that can be appropriated by the winner of the contest.

Proposition 2 *Consider a small shift of the function $B(k)$ to some $\tilde{B}(k)$ with $\tilde{B}'(k) > B'(k)$ for all $k \geq 0$. If $k^s < K$ then this shift increases equilibrium investment to $\tilde{k}^s$ such that $\tilde{B}'(\tilde{k}^s) = 1$. If $k^c > K$ then this shift increases equilibrium investment to $\tilde{k}^c$, such that $(1-b)\tilde{B}'(\tilde{k}^c) = 1$. If $k^s > K > k^c$, then this shift reduces the equilibrium investment from K to $\tilde{K}$ with $\tilde{B}(\tilde{K}) = a/b$.*

The result is straightforward from Figure 1. Suppose the bold parts of the curves $B'(k)$ and $(1-b)B'(k)$ shift upward. This implies that k^s and k^c in cases (i) and (iii) move to the right. Further, the amount K of investment at which $B(K) = \int_0^K B'(k)dk = a/b$ shifts to the left. □

The critical investment level at which the prize becomes sufficiently large to trigger a contest becomes smaller if the investment becomes more productive or if the output becomes more valuable, or if the winner of the contest can appropriate a larger share of the output. Accordingly, if the equilibrium investment level is this critical level K, an increase in productivity or an improvement in the appropriation technology will reduce the equilibrium level. In order to keep future contestable rents below the threshold that is determined by the (exogenously given) headstart incumbency advantage, the incumbent has to reduce his investment.[14]

[14]The results in proposition 2 are based on the kink in the payoff function and resemble some preemption games in industrial organization. For instance, Fudenberg, Gilbert, Stiglitz and Tirole (1983) show that it depends on the value of a patent, and the size of

Security and investment behavior. The case-(ii) equilibrium with investment equal to K in Proposition 1 shows that, even if no contest effort is observed, and no office change takes place, the investment disincentives due to potential conflict can be large. For instance, for the extreme case with $a = 0$ and $b = 1$, there is no conflict in the equilibrium, and at the same time, there is zero investment. The two types of incumbency advantages work into the same direction in the case-(ii) equilibrium: by (7), $\frac{dK}{da} = 1/(bB'(K)) > 0$, and $\frac{dK}{db} = -B/(bB') < 0$.

The different dimensions of incumbency advantages affect investment differently in the case-(iii) equilibrium in which a contest occurs. By (5) and (6) the equilibrium probability for staying in office is $\pi(a, b, B) = 1 - \frac{b}{2} + \frac{a^2}{2bB^2}$, whereas the investment disincentives are characterized by $(1-b)$ at the margin in this equilibrium. Accordingly, starting from some situation in which the equilibrium investment is k^c, there are many combinations (a, b) of headstart advantages and productivity advantages that lead to the same probability of an office change and very different equilibrium investment levels.

These comparative static properties show that the observed frequency of turnover is neither a good predictor for an incumbent's security, nor for his investment incentives.

5 Evidence

This section confronts the theory results with some piecemeal evidence on dictatorship and leadership in organizations. The analysis predicts that, everything else given, there is a tendency for more conflict if there is more at stake. This prediction is closely matched in the empirical data on civil war and social conflict. Natural resource stocks are preferred sources of revenue for the rulers, and generate a considerable incentive for rivals to enter into an appropriation conflict. Indeed, a close relationship between countries' stocks of natural resources that can be acquired by a proprietary government and conflict or civil war is found. Evidence for this close relationship is surveyed in Collier (2001). He concludes, based on a number of empirical studies he and his coauthors conducted, that for a broad range, the risk of rebellion is increasing in primary commodity dependence of a country. Accordingly, an unexpected appreciation of a country's stock of natural resources, or the discovery of such resources destabilizes the system and generates conflict.

Further, this paper suggests that dictators' investment behavior depends on their incumbency advantages. The evidence on this is less systematic.

information lags between firms whether a firm's headstart advantage eliminates a patent race.

We may compare two countries, Saudi Arabia and Nigeria, the largest oil exporters among Arabian and African countries, respectively.

Saudi Arabia is characterized by a stable monarchy which traces back to the 18th century and is deeply rooted in the history of the Arabian peninsula, and in religion (Hopwood, 1982). On a scale from 1 (least fractionalized) to 100 (most fractionalized), Saudi Arabia earns a "6" for ethno-linguistic fractionalization (see Mauro, 1995). Even though fractionalization of countries is not necessarily exogenous this could be a proxy for incumbency advantages. Hence, our theory predicts use of oil revenues for building up infrastructure and for investing in education and in state owned foreign assets. Indeed, the incentives of the kingdom to invest have been expressed by government officials (see, e.g., Abdullah al Saud, in: Niblock, 1982, p.304), and Saudi Arabia has invested a major share of petroleum income in infrastructure, education, and in building up non-oil industries.[15]

Nigeria, the largest oil exporter in Africa, has an '87' on the ethno-linguistic fractionalization index (Mauro, 1995). It had 11 country leaders since 1960, eight of which were military. Five were replaced by a coup. One was assassinated, one "stepped aside" and one "resigned" after less than one year in office (*Economist*, January 15, 2000, p.4). Nigerian rulers face competition for office. Nigeria could be a prosperous country and could have invested its oil money in education, infrastructure or state owned foreign assets. Instead, per-capital income in nominal US dollars decreased to less than 1/3 of what it was in 1980 (*Economist*, January 15, 2000, p.5), country leaders preferred to accumulate assets on their own foreign accounts, and when the latest change in office took place and Olusegun Obasanjo returned to office in 1999, he inherited a country that lacks infrastructure but accumulated a stock of public debt to foreigners of USD 30b. (Simon Robinson, *Time Europe*, December 27, 1999). While this paper cannot provide a systematic empirical analysis, these examples could be suggestive for what could be the direction of such an analysis.

Turning to organizational aspects of firms, the relationship between incumbency advantages and managerial incentives can be used to discuss some of the empirical results on CEO turnover and firm profitability. Considerable evidence shows a negative correlation between firm performance and CEO turnover.[16] This correlation is typically interpreted as evidence for CEO

[15]For instance, the Saudi Arabian 'second five-year plan' for 1975-1980, proposed development expenditure amounted to USD 142b., about four times the GDP at that time, and the non-oil sector grew with annual real rates of between 12.9 and 19.6 percent between 1972 and 1976 (Moliver and Abbondante, 1980, p.2 and p.42).

[16]Some references confirming this are Warner, Watts, and Wruck (1988), Weisbach (1988) and Kaplan (1992). See also Conyon, Gregg and Machin (1995) for a survey.

turnover to be a disciplinatory instrument. The results in this paper suggest that a different causality could also contribute to this correlation: suppose a CEO has strong headstart advantages. This can lead to a low probability of losing the struggle for power and being replaced and can generate incentives to increase firm growth and profits, provided that the CEO's incentives are somewhat aligned with shareholders' goals by other incentive instruments. Incumbency advantages could therefore be a hidden variable that contributes to the correlation between CEO turnover and firm performance. Incumbency advantages may have several causes, some of which are observable, and this is where an empirical analysis could start. Change in legislation may change incumbency advantages. The homogeneity of the industry in which a firm operates could have an impact on the cost of replacement of the CEO, and lower replacement cost reduces incumbency advantages.[17] Also, a CEO can increase incumbency advantages by manager-specific investments. Some costs and benefits of such investment have been discussed by Shleifer and Vishny (1989) and Mitusch (2000). The results in this paper suggest a further reason why manager-specific investment could be beneficial, not only for the manager, but also for the shareholders.

6 Some generalizations

In this section a number of assumptions is briefly discussed: timing of moves, the contest function, constrained budgets for contest effort, and additional and countervailing aspects of infrastructure investment.

Timing of moves. Three decisions are made: k, w, and $\bar{w}$. The interesting aspect of k here is its role as a strategic variable: the incumbent can choose k and influence the rival's behavior in the contest. This is why consideration is restricted to k being chosen before $\bar{w}$. However, there is no need for w and $\bar{w}$ to be chosen simultaneously. If, for some reason, the rival has to choose her contest effort before the period-1 incumbent, if $a > 0$ and $b < 1$, the incumbent would always top any reasonable effort spent by the rival and hence, the equilibrium is characterized by $w = \bar{w} = 0$, and by an investment level that is given by (9). Accordingly, for this type of timing, the hold-up problem disappears. If, instead, w can be chosen prior to $\bar{w}$[18], the equilibrium does not change much. The incumbent chooses a sufficient

[17] For instance, Geddes and Vinod (1997) report that homogeneity of the industry decreases the duration of the CEO's stay.

[18] Lundahl's (1992) account of Haiti's history prior to and during Duvalier's dictatorship serves as a case study that highlights the role of investment in a dictator's security and may also serve as an example for a change from a regime with Nash contests for power to Stackelberg leadership. Haiti had 22 rulers from 1843 to 1915, eleven of them ousted within

amount of effort to prevent the rival from entering the contest and the rival stays out ($w = \max[bB(k) - a, 0]$ and $\bar{w} = 0$). Investment and welfare are the same as in the case with simultaneous contests. The incumbent stays in power in this case with probability 1, however.

Contest functions. The contest function (2) is sometimes considered an extreme case because it is the limiting case of a more general class of contest success functions for which the win probability is a continuous function of effort that has been axiomatized by Skaperdas (1996). The results in propositions 1 and 2 are very general and also hold for incumbency advantages with this general class of contest success functions. For instance, consider the famous Tullock (1980) contest success function, augmented by a headstart advantage: suppose the winning probability of the incumbent is

$$q(w, \bar{w}) = \frac{w + a}{w + \bar{w} + a}, \tag{11}$$

and the rival wins with probability $(1 - q)$. In the resulting contest equilibrium, contestants choose efforts $w = (B/4) - a$ and $\bar{w} = B/4$ if $B(k) > 4a$, $w = 0$ and $\bar{w} = \sqrt{aB} - a$ if $B(k) \in (a, 4a]$, and $w = \bar{w} = 0$ for $B(k) < a$. Substituting in (3) yields an equilibrium payoff $\Omega(k)$ for the incumbent, with

$$\frac{d\Omega(k)}{dk} = \begin{cases} -1 + B'(k) & \text{if} \quad B(k) < a \\ -1 + \frac{1}{2}\frac{\sqrt{a}}{\sqrt{B}}B'(k) & \text{if} \quad B(k) \in (a, 4a] \\ -1 + \frac{1}{4}B'(k) & \text{if} \quad B(k) \geq 4a \end{cases} . \tag{12}$$

The derivative $\frac{d\Omega(k)}{dk}$ is not defined at $B(k) = a$. We define the amount of investment for which $B(k) = a$ as K, analogously to (7). Note that we consider only a headstart advantage here, hence, $b = 1$. At K the marginal payoff of an increase in investment drops from $(-1+B'(K))$ to $(-1+\frac{1}{2}B'(K))$. This discontinuity is caused by the fact that the rival chooses $\bar{w} = 0$ for $k < K$, and starts choosing positive effort for $k > K$. The same three types of possible equilibrium as in proposition 1 can occur: an equilibrium in the range $k < K$, in which no contest occurs, an equilibrium in the range $k > K$, in which the rival or both the rival and the incumbent spend positive contest effort, and an equilibrium with $k = K$, in which the incumbent preempts a contest by choosing a sufficiently low investment. Also the qualitative properties of these equilibria are the same as in proposition 2. In particular, the same counterintuitive result about an increase in investment productivity in an equilibrium at K obtains: if $B(k)$ is replaced by $\tilde{B}(k)$ with $\tilde{B}'(k) >$

less than one year. Duvalier, however, made every effort and employed vast resources to fight all possible opposition in his first 5 years of office, and, by continuing to spend considerable resources, he and his family ruled the country for more than 26 years.

$B'(k)$, the threshold amount of investment K reduces to $\tilde{K}$ that is determined by $\tilde{B}(\tilde{K}) = a$, and so does the equilibrium investment for changes in $B(k)$ for which the equilibrium stays in the threshold.

Constrained budgets. An important aspect that is neglected here is the fact that the incumbent or the rival or both may be budget constrained. The problem disappears if there are perfect credit markets, but in a world without property rights, capital markets are typically incomplete. Two super-powers may back up the contestants in the proprietary state, in which case the budget constraints disappear. If only the rival is budget constrained, the contest equilibrium as in lemma 1 is replaced by an equilibrium that generalizes the analysis by Che and Gale (1998), and the investment disincentives that are generated by the contest are expected to be less strong. The problem becomes more complex if the incumbent faces a budget constraint and uses the same type of resources for making investment and for contest effort, as is assumed in general equilibrium models as considered in Skaperdas (1992) or in Konrad and Skaperdas (1999) where a fixed budget can be allocated among various uses, such as production, protection, appropriation and others, or if resources have to be allocated between several periods of conflict.

Additional effects of investment. So far, it has been assumed that the investment changes the prize, but does not change the contest technology. However, investment may also change incumbency advantages. For instance, applied to the proprietary state, investment in infrastructure or education may induce growth, making people happier with their ruler, and this may stabilize the ruler's regime. This has been claimed and analyzed in the context of proprietary finance, by Grossman (1991, 1999) and Grossman and Noh (1994). Alternatively, economic development may induce political transition and generate a politically active opposition. Hence, investment may reduce political stability. Robinson (1999) surveys historical evidence and an analysis showing that policies that promote economic development can affect the distribution of political power to the disadvantage of the ruling elite.

The effect of investment on, for instance, the headstart advantage can be incorporated in the analysis in sections 2 and 3. Suppose, for instance, that $a = a(k)$. To make the problem well-behaved, suppose further $a(0) > 0$, and $\frac{a'(k)}{b} < B'(k)$. The latter condition is clearly fulfilled if investment reduces incumbency advantages, and also holds if investment increases incumbency advantages only moderately. The contest equilibria as characterized in lemmas 1 and 2 are unaffected, as $a(k)$ is given at the contest stage. However, the incumbent will take into account that investment also changes his headstart advantage. Equilibria with investment levels, k^s and k^c, respectively, and their comparative static properties with respect to $B(k)$, do not change, as a

does not even enter the conditions (9) and (10) determining these investment levels. The equilibrium at the threshold level of investment K, at which a contest sets in, changes, but not much. The threshold level is characterized now by $B(K) = \frac{a(k)}{b}$, and this equation has (at most) one solution. Also the comparative statics of this equilibrium stay qualitatively the same. However, the overall effect of an increase in $B(k)$ is reinforced if $a'(k) < 0$, and reduced if $a'(k) > 0$. But these effects add to the effect considered in this paper, and do not eliminate it.

7 Conclusions

In many situations economic agents who can make an investment that generates output in the future must enter a contest for appropriating this output. This paper analyzed the investment incentives of such agents and the role of incumbency advantages in the contest. An increase in the productivity of the investment can decrease or increase the amount of investment. This is particularly important if a certain amount of investment triggers a contest for the output of such investment. The agent who can choose the amount of investment then may want to keep the output below this critical level, and if the investment becomes more productive, investment may fall. These results reveal two types of welfare losses. Losses occur in terms of the appropriation effort that is spent in the contest about who appropriates the returns on the investment. Second, because these effort costs are triggered by the returns of the investment there is an incentive for unterinvestment. The results are applied to dictators' investment behavior, and managers' investment in organizations. In the context of proprietary states, the results lead to testable hypotheses and can explain, for instance, why dictators with similar objectives may choose very different policies as regards the economic development of their countries.

8 Appendix

Proof of Lemma 1. A strict proof of uniqueness of the equilibrium in case (i) follows lines drawn by Baye, Kovenock and deVries (1996).[19] We only confirm that (5) and (6) indeed constitute an equilibrium. For this it must hold that, for given F as defined in (5), all choices $\bar{w} \in \{0\} \cup [\frac{a}{b}, B]$ yield the same payoff for the rival, a payoff not lower than any choice from outside this

[19] Baye, Kovenock and deVries (1996) consider a special case that is isomorphic to the case with $a = 0$.

set. Inserting in the payoff function shows that any choice $\bar{w} \in \{0\} \cup [\frac{a}{b}, B]$ yields $\Phi = 0$, whereas a choice of $\bar{w} \in (0, \frac{a}{b})$ yields a strictly negative payoff equal to $-\bar{w}$, and a choice $\bar{w} > B$ yields strictly negative payoff equal to $-(\bar{w} - B)$.

Similarly, it must hold that, for given $\bar{F}$ as defined in (6), all $w \in [0, bB-a]$ yield the same expected payoff not lower than the payoff attained with any other choice of w. Indeed, inserting (5) and (6) in the incumbent's payoff function shows that all these choices yield payoff equal to $(1-b)B + a$. If the incumbent chooses effort higher than $bB - a$, his payoff is reduced by the difference $w - (bB - a)$ as he already wins the contest with probability one if he chooses $w = bB - a$.

The case (ii) with $B < \frac{a}{b}$ is comparatively simple. The rival cannot win unless he spends effort that exceeds B, his valuation of the prize. But his payoff in these cases is negative and hence smaller than for $\bar{w} = 0$ which is a unique dominant strategy. The incumbent's optimal response to this dominant strategy is $w = 0$. □

9 References

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