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Abstract: As a result of principal-agent's problems in the banking system, there are rents present within the banking system. This paper presents a model where rents are contestable and promotion of employees within an internal bank is determined by individuals' allocation of time between rent seeking and productive activity. In this paper we try to examine whether less productively efficient people can be expected to be in senior management positions at the banking system.

Key words: Rent seeking, Promotion, Banks, Contest.
JEL classification: D2, D72, J2.

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1. Introduction

Because of principal-agent's problems in the banking system, there are rents present within the bank. If rents are present, then they can be contested. Many banks have difficulty in assessing their employees' contribution to the total output and profit of the bank. Citing Radner (1993): "If we look at individuals in a bank, especially in the management sector, it is rare that we find a person whose output can be realistically measured in money or any other one-dimensional variable." This difficulty generates "influence costs" that have been defined by Milgrom and Robert (1992) as follows: "The costs included in attempts to influence others' decisions in a self-interested fashion, in attempts to counter such influence activities by others, and by the degradation of the quality of decisions because of influence."

As the manager at the bank has not got full knowledge of his/her employees' productivity level this allows the employees to try and influence the employers decision regarding promotion. This influence can be seen as rent seeking activity intended to receiving the rents of promotion within the banking system. The rents in the bank become, therefore, contestable.[1]

The question posed is whether the presence of the rents also implies that those more adept at rent seeking have an internal advantage in seeking promotion in the hierarchy of career advancement in banks.

The model displays a population of employees differentiated in productivity and rent seeking abilities, and investigates the likelihood of people with different attributes

[1] It is not clear whether the employer designs a rent- promotion - seeking contest or not however empirical studies and others such as Cleveland and Murphy (1992), Altman, Vanlenzi and Hodgettes (1985), Tziner (1999) have shown that employees invest in non productive activities in order to increase their performance appraisal and believe that such activities will increase their probability of being promoted. Moreover, Tziner, Latham, Prince and Haccoum (1996) developed an instrument (PCPAQ) capable of quantitatively measuring the extent to which specific political considerations affect performance appraisal. In contrast to the above mentioned papers, this paper looks at the investment in non-productive activities as a worker's optimal choice relative to the choice to investment in real productive activities by developing a rest seeking contest between the employees inside the bank. We consider the effect of the employees productivity level and the rent seeking ability on the probability of promotion in equilibrium

succeeding in attaining promotion. More specifically we investigate whether, conversely, the senior management of banks can be expected to be dominated by individuals who have low productivity levels but with or without advantage in rent seeking activities. The answer in general depends on the incentives within the bank. The incentives can be in terms of increase in wages from one rung to the other, rent-seeking abilities of the candidates and rent seeking opportunities on the different rungs of the bank's ladder.

The bank, in the model, has a pyramid structure: the number of employees decline at higher levels of the internal hierarchy and only one incumbent is situated at the top-level of the hierarchy. Internal rent seeking contests take place on each rung of the bank in order to win promotion, and thereby secure increased rents. The outcome of the internal rent seeking contests depends on the magnitude of the income differential between hierarchical levels. The problem confronting more productive employees is whether it is worth their while participating in the internal rent seeking contests.

A substantial literature discusses how managers advance via competition through the ranks of the firm (see for example Beckmann 1978). A career path is the outcome of competition among peers with the objective of attaining higher rungs and correspondingly more remunerative positions during the life cycle. Successful contestants seek more prosperity and occupy themselves with winning further promotion at the expense of production. This is possible because of the ambiguities of measuring the individual's contribution to output (see Radner 1993). This paper emphasizes how, in the same context, rents figure prominently in banks and show how rent-seeking influences promotion prospects.

Hierarchical rent seeking, as is present in my model, is also present in Hillman and Katz (1987). They evaluate the social losses due to resources used to contest a bribe that is transferred up a hierarchy. In the Hillman-Katz model, the rent enters the hierarchy exogenously. In my model of a hierarchical bank, the value of the rent is endogenous, and reflects the incentives within the bank to divide time between rent seeking and productive activity. This, in turn, reflects the heterogeneous characteristics of bank's employees as rent seekers and the internal bank structure.

Lazear and Rosen (1981) and Rosen (1986) and Lazear (1996, and references within), in papers along similar lines, investigated the incentives of prizes increasing survival in sequential elimination events. The most highly qualified contestant is determined by tournament. Success is based on "survival of the fittest", which maintains "quality of play" as the game progresses. Their models identify the unique role of top-ranking prizes in maintaining performance incentives in career and other survival games: how the equilibrium reward structure favors the top-ranking prizes, encouraging competitors to aspire to further heights, regardless of past achievements. By contrast, in the present model, productivity cannot be fully observed by the employer and the outcome of promotion contests does not ensure efficiency.

2. The Model

Overview

The model has the following characteristics. There are two employees who are risk neutral and seek to maximize expected income defined over two periods. The bank also has two hierarchical levels.[2] Contesting promotion is costly in time and lost income, since productive work is directly rewarded, not the time spent in (self) promotional activities. Workers have different benefits in ingratiating themselves via rent seeking and in contributing to the value of the bank's output. The workers' productivity level, plus the rents that accrue at different rungs of the hierarchy, determines an individual's income.

The employer cannot distinguish precisely between the rent seeking activities and the real production activities of the workers, thus enabling workers to compete for rents and promotion on the different rungs of the bank. If the employer could fully distinguish between productive activities and rent seeking activities, he/she would promote the productive worker. [3]

The question is: who is promoted to senior management of the bank? That is, is there adverse selection in the promotion contests?.

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[2] The results can be generalized to a larger number of rungs within a bank and where the number of employees declines while climbing the rungs of the bank's ladder.

[3] See for example, Milgrom and Roberts (1992) and Epstein and Spiegel (1997, 2001).

The structure of the model

In the first period, while working on the first rung, the employees can choose to compete in order to attain a higher position in the bank. The worker who loses (or did not enter the contest) continues working on the same rung as before the contest. The employee who wins the competition will come into office in the second period.

The productivity level of worker *i* is denoted by v_i $(i=1,2)$. v_i defines the absolute productive efficiency for one unit of time. The earnings of a worker on the second rung are denoted by p_i $(i=1,2)$. Income per unit of labor is an increasing function of an individual's productivity. Thus the worker's earnings are determined by the worker's productivity level *plus* the income from rent seeking. Therefore, p_i is a function of the worker's productivity level, v_i, and of his/her rent seeking abilities, d_i.

Each individual has an endowment of labor time, normalized to unity, that is allocated between productive activities A_i and time L_i spent in rent seeking:

$$A_i + L_i = 1 \tag{1}$$

In the first period rent seeking activities are divided into two parts: seeking promotion, L_i^1 and seeking an increase present income, L_i^2. A worker's income in the first rung is composed of his real contribution to the bank, $v_i(1-L_i^1-L_i^2)$, plus the income generated from rent seeking, $R_i\left(v_i, L_i^2\right)$. It is assumed that $\frac{\partial R_i\left(v_i, L_i^2\right)}{\partial L_i^2} > 0$ and $\frac{\partial^2 R_i\left(v_i, L_i^2\right)}{\partial\left(L_i^2\right)^2} < 0$. After the contest, regardless of winning or losing the contest, the worker returns to rent seeking in order to increase his present income on a given rung. In the first period the worker's income equals:[4]

[4] It is clear that the employer could not create a contest that will promote the productive employee by promoting the one with the highest wage in the first period, as this wage could be a result of rent seeking activities.

$$I_i = v_i(1 - L_i^1 - L_i^2) + R_i\left(v_i, L_i^2\right) \tag{2}$$

Denote by Pr_1 the probability that worker number 1 wins the contest and receives, in the second period, an income of $p_1\left(v_1, d_1\right)$ (hereafter p_1). With probability *(1- Pr_1)* the worker loses the contest and thus earns an income of $f_1\left(v_1, d_1\right)$ (hereafter f_1) in the second period.[5] The income a worker receives in the second period after the contest, whether he wins the contest (p_1) or loses it (f_1), depends on the worker's productivity level, v_1, and his ability to rent seek, d_1. *Thus both p_1 and f_1 are a function v_1, and d_1.* Moreover, there may well be a negative or positive correlation between the productivity level of the worker, v_1, and his ability to rent seek, d_1. d_1 is therefore a function of the productivity level of the worker. This dependency may go in the two directions: increasing the productivity of the worker may increase or decrease his rent seeking abilities.

In order to simplify the matter, and without loss of generality, let the discount factor be one. The expected income/utility of worker 1 is given by:

$$\begin{aligned} E\left(I_1\right) &= v_1(1 - L_1^1 - L_1^2) + R_1\left(v_1, L_1^2\right) + f_1\left(1 - \Pr_1\right) + p_1 \Pr_1 \\ &= v_1(1 - L_1^1 - L_1^2) + R_1\left(v_1, L_1^2\right) + f_1 + \left(p_1 - f_1\right)\Pr_1 \end{aligned} \tag{3}$$

In a similar way we can write worker number 2's expected income/utility:

$$\begin{aligned} E\left(I_2\right) &= v_2(1 - L_2^1 - L_2^2) + R_2\left(v_2, L_2^2\right) + f_2\left(1 - \Pr_2\right) + p_2 \Pr_2 \\ &= v_2(1 - L_2^1 - L_2^2) + R_2\left(v_2, L_2^2\right) + f_2 + \left(p_2 - f_2\right)\Pr_2 \end{aligned} \tag{4}$$

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[5] Using the notation set above $f_i = v_i(1 - L_i) + R_i\left(v_i, L_i\right)$ however there is not advantage in this stage to breakup f into its two components.

2.1 The Information Structure

Consider an employer who has to choose which of his employees to promote. Neoclassical economic theory assumes that the employer has a utility that allows him to rank these alternatives, choosing the highest ranked. Psychologists (e.g. Luce (1959), Tversky (1969) and (1972)) criticized this deterministic approach, arguing that the outcome should be viewed as probabilistic process. Their approach is to view utility as deterministic but the choice process to be probabilistic. The employer does not necessarily choose the alternative that yields the highest utility and instead has a probability of choosing each of the various possible alternatives. Luce (1959) (see also Sheshinski (2000)) shows that when choice probabilities satisfy a certain axiom (the choice axiom), a scale, termed utility, can be defined over alternatives such that the choice probabilities can be derived from scales, utilities, of alternatives.

The contest present below, may not be designed by the employer rather it may well be that the employees believe that such a contest exists. In the literature, it has been shown that workers invest time in non-productive activities – "political activities" which they believe increase the probability of being promoted (see for example Cleveland and Murphy, 1992, Altman, Vanlenzi and Hodgetts, 1985 and Tziner 1999). Thus, even though from the employer's point of view the contest does not exist it may well exist in the eyes of the employees and the employees invest accordingly in such non productive activities.

Let us look at the broad picture and derive some general results. Later on in the paper, in order to obtain more specific results, we will choose some more restricted formulation of the probability of promotion.

2.1.1. The general model

The objective of the workers is to maximize their expected income/utility by determining the level of investment in promotion seeking activities. Expected income is determined by the Nash equilibrium choices of rent seeking, which follows, for worker *i* from:

$$G_i = \frac{\partial E(I_i)}{\partial L_i^1} = -v_i + (p_i - f_i)\frac{\partial \Pr_i}{\partial L_i^1} = 0 \quad \forall\, i = 1,2 \tag{5}$$

$$D_i = \frac{\partial E(I_i)}{\partial L_i^2} = -v_i + \frac{\partial R_i(v_i, L_i^2)}{\partial L_i^2} = 0 \quad \forall\, i = 1, 2 \tag{6}$$

Notice that in order to solve the values of L_i^1 we need to solve the equation (5) for both players. It is assumed that $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial L_i^1} > 0$, $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial L_j} < 0$, $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial d_i} > 0$, $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial d_j} < 0$, $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial v_i} > 0$ and $\frac{\partial \Pr ob_i(L_i^1, L_j^1)}{\partial v_j} < 0$. Moreover we assume that the marginal effect of the probability decreases with an increase in the different variables $\left(\frac{\partial^2 \Pr ob_i(L_i^1, L_j^1)}{\partial L_i^{1^2}} < 0\right)$. It can easily be shown that the second order conditions can be verified. *In order to put this into focus we disregard, at this stage, the ability level of promotion seeking worker (d_i).*

From the first order condition it is clear that the marginal effect of a unit of investment in promotion seeking activities on the probability of promotion will equal:

$$\frac{\partial \Pr_i}{\partial L_i^1} = \frac{v_i}{(p_i - f_i)} \quad \forall\, i = 1,2 \tag{7}$$

It can be shown that the Nash equilibrium in the determination of the levels of investment in promotion activities satisfies:

$$\frac{\partial L_i^1}{\partial v_i} = \frac{\frac{\partial G_i}{\partial L_j^1}\frac{\partial G_j}{\partial v_i} - \frac{\partial G_j}{\partial L_j^1}\frac{\partial G_i}{\partial v_i}}{\frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1} - \frac{\partial G_j}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1}}, \quad \frac{\partial L_i^1}{\partial v_j} = \frac{\frac{\partial G_i}{\partial L_j^1}\frac{\partial G_j}{\partial v_j} - \frac{\partial G_j}{\partial L_j^1}\frac{\partial G_i}{\partial v_j}}{\frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1} - \frac{\partial G_j}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1}},$$

(8)

$$\frac{\partial L_j^1}{\partial v_i} = \frac{\frac{\partial G_j}{\partial L_i^1}\frac{\partial G_i}{\partial v_i} - \frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial v_i}}{\frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1} - \frac{\partial G_j}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1}} \quad \text{and} \quad \frac{\partial L_j^1}{\partial v_j} = \frac{\frac{\partial G_j}{\partial L_i^1}\frac{\partial G_i}{\partial v_j} - \frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial v_j}}{\frac{\partial G_i}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1} - \frac{\partial G_j}{\partial L_i^1}\frac{\partial G_j}{\partial L_j^1}}$$

The question we would like to pose at this point is: who has the higher probability of being elected, is it the least or most productive worker? We thus would like to examine how a change in the productivity of one worker affects the probability of promotion: $\frac{d\,\mathrm{Pr}_i}{d\,v_i}$. We may write this in the following way:

$$\frac{d\,\mathrm{Pr}_i}{d\,v_i} = \frac{\partial \mathrm{Pr}_i}{\partial L_i^1}\frac{\partial L_i^1}{\partial v_i} + \frac{\partial \mathrm{Pr}_i}{\partial L_j^1}\frac{\partial L_j^1}{\partial v_i} \qquad (9)$$

Rewriting (9) together with (7) and (8) we obtain for worker number 1:

(10)

$$\frac{d\,\mathrm{Pr}_1}{d\,v_1} = \frac{(p_2 - f_2)}{A}\left(\eta_{\,p_1 - f_1, v_1} - 1 + (p_1 - f_1)\frac{\partial^2 \mathrm{Pr}_1}{\partial L_1^1 \partial v_1}\right)\left(\left(-\frac{\partial^2 \mathrm{Pr}_2}{\partial L_2^{1\,2}}\right)\frac{\partial \mathrm{Pr}_1}{\partial L_1^1} + \frac{\partial^2 \mathrm{Pr}_2}{\partial L_2^1 \partial L_1^1}\frac{\partial \mathrm{Pr}_1}{\partial L_2^1}\right)$$

$$+$$

$$\frac{(p_2 - f_2)}{A}\frac{\partial^2 \mathrm{Pr}_2}{\partial L_2^1 \partial v_1}\left(\frac{\partial^2 \mathrm{Pr}_1}{\partial L_2^1 \partial L_1^1}\frac{\partial \mathrm{Pr}_1}{\partial L_1^1} + (p_1 - f_1)\left(-\frac{\partial^2 \mathrm{Pr}_1}{\partial L_1^{1\,2}}\right)\frac{\partial \mathrm{Pr}_1}{\partial L_2^1}\right)$$

where $A = (p_2 - f_2)(p_1 - f_1)\left[\frac{\partial^2 \Pr_1}{\partial {L_1^1}^2}\frac{\partial^2 \Pr_2}{\partial {L_2^1}^2} - \frac{\partial^2 \Pr_1}{\partial L_1^1 \partial L_2^1}\frac{\partial^2 \Pr_2}{\partial L_1^1 \partial L_2^1}\right]$ and

$\eta_{p_1 - f_1, v_1}$ represents the elasticity of the increase in wages as a result of a change in the productivity of the worker 1 : $\eta_{p_1 - f_1, v_1} = \frac{\partial (p_1 - f_1)}{\partial v_1}\frac{v_1}{(p_1 - f_1)}$.

In order to understand this result we assume that $\frac{\partial^2 \Pr_1}{\partial {L_1^1}^2} < 0$, $\frac{\partial^2 \Pr_2}{\partial {L_2^1}^2} < 0$, $\frac{\partial^2 \Pr_1}{\partial L_1^1 \partial L_2^1} < 0$, $\frac{\partial^2 \Pr_2}{\partial L_1^1 \partial L_2^1} < 0$ and as $\Pr_1 + \Pr_2 = 1$ A>0 (later we will analyze a specific function in order to illustrate the results). Assuming that the probability of worker *i* being promoted is not directly affected by workers *i's and j*'s productivity level: $\frac{\partial \Pr_i}{\partial v_j} = 0$ and $\frac{\partial^2 \Pr_i}{\partial L_i^1 \partial v_i} = 0$ then we obtain

$$\frac{d \Pr_1}{d v_1} = \frac{(p_2 - f_2)}{A}\left(\eta_{p_1 - f_1, v_1} - 1\right)\left(\left(-\frac{\partial^2 \Pr_2}{\partial {L_2^1}^2}\right)\frac{\partial \Pr_1}{\partial L_1^1} + \frac{\partial^2 \Pr_2}{\partial L_2^1 \partial L_1^1}\frac{\partial \Pr_1}{\partial L_2^1}\right) \qquad (11)$$

Thus the sign of $\frac{d \Pr_1}{d v_1}$ rests on the sign of $\left(\eta_{p_1 - f_1, v_1} - 1\right)$ therefore $\frac{d \Pr_1}{d v_1} > 0$ iff $\eta_{p_1 - f_1, v_1} > 1$. In other words, if the increase in wages from going up the rungs of the bank is sufficiently large for the productive worker, then this worker will have a higher probability of winning the promotion.

Now to return to the more general case where $\frac{\partial^2 \Pr_i}{\partial L_i^1 \partial v_j} < 0$ $\frac{\partial^2 \Pr_i}{\partial L_i^1 \partial v_i} > 0$ and $\frac{\partial \Pr_i}{\partial v_j} < 0$. In this situation we see that in order for $\frac{d \Pr_1}{d v_1} > 0$ it is not necessary that $\eta_{p_1 - f_1, v_1} > 1$. This means, that if there is a direct effect of the workers productivity on the probability of promotion, the increase in income from one rung to the other needed to insure that the more productive worker wins the promotion is smaller than in the case where the probability is not directly affected by the productivity levels of the workers.

In order to be able to understand the effect of the different assumptions on the probability of promotion function and in order to be able to look at other issues more clearly, we now turn to a more specific probability function.

2.1.2. Luce's (Multinomial) Logit Model

Luce's (Multinomial) *Logit Model* postulates that the probability that an individual chooses some alternative $a \in S$, $\Pr_a$, is given by

$$\Pr_a = \frac{e^{q_a u(a)}}{\sum_{b \in s} e^{q_b u(b)}} \tag{12}$$

Where the parameter q_a represents the preferences of the employer (discrimination, or in our context, the ability to rent seek of the worker). If $q_b = 0$ for all b then each employee has equal probability of being promoted. The uncertainty is emphasized in the case where the employer has not got full information regarding his employee's real contribution to the bank's profits. In this setting $u(a)$ represents the value attributed by the employer to the worker's productivity level. As stated above, the employees invest effort in rent seeking activities that causes the employer not to know their (and their opponents) actual productivity level. The utility that is attributed by the employer to worker i is given by $u(v_i, L_i^1)$. In order to simplify the calculations and to be able to reach a closed form let the utility be the logarithmic function such that $u(v_i,L_i^1) = Ln\left(v_i^{\alpha} L_i^1\right)$. Thus, the utility increases with the investment in rent seeking activity of the employee. As the employee's investment level increases he better disguise himself as a productive worker or convinces the employer that he really is the productive worker. The values of α represents the level of information the employer has regarding the workers productivity level and/or the weight assigned by the employer to the productivity level of the worker in his decision. As α increase the employer puts a higher emphasis on the workers productivity level. If α=0 the employer has no knowledge regarding the workers productivity level and thus the utility depends only of the workers investment in rent seeking activities. If $\alpha = \infty$

the employer has full knowledge of the employees' productivity levels and uses only this information when considering promotion. We thus obtain a contest-success function, that worker *i*'s probability of success in competing against *j* is given by:

$$\Pr ob_i(L_i, L_j) = \frac{d_i\, L^1{}_i\, v_i^{\alpha}}{d_i L_i^{\,1} v_i^{\alpha} + d_j L_j^{\,1} v_j^{\alpha}} \quad \forall i \neq j, \quad i, j = 1,2 \ \ and \ \ \alpha \geq 0 \tag{13}$$

where $e^{qi} = d_i$ represents the rent seeking ability of the employee.

This contest success function is a variant of the non-discriminating rule of Tullock (1980) (see also Hirshleifer, 1989 and Hillman and Riley, 1989). The probability of winning the contest is therefore determined by the following variables:

a. The level of investment in rent seeking activities in order to be promoted, L_1 and L_2,

b. The rent seeking abilities of the candidates, d_1 and d_2,

c. The productivity levels of the candidates, v_1 and v_2.

d. The amount of information the employer has regarding the productivity level of the worker, α.

Thus, $\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial L_i^{\,1}} > 0$, $\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial L_j} < 0$, $\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial d_i} > 0$,

$\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial d_j} < 0$ and $\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial v_i} > 0$, $\frac{\partial \Pr ob_i(L_i^{\,1}, L_j^{\,1})}{\partial v_j} < 0$

Equilibrium

Each worker maximizes his/her expected income/utility by choosing the extent of rent seeking[6]. Expected income is determined by the Nash equilibrium choices of rent seeking, which follows, for worker number 1 from:

[6] It is not clear that the results would vary from those presented here if an individual could change the level of investment during the process of the contest while receiving new information (see Epstein, 1996).

$$\frac{\partial E(I_1)}{\partial L_1^1} = -v_1 + \left(p_1 - f_1(v_1, d_1)\right)\frac{d_1 d_2 v_1^{\alpha} v_2^{\alpha} L_2^1}{(d_1 v_1^{\alpha} L_1^1 + d_2 v_2^{\alpha} L_2^1)^2} \qquad (14)$$

and $\frac{\partial E(I_1)}{\partial L_1^2} = -v_1 + \frac{\partial R_1}{\partial L_1^2} = 0$

Similarly, the second worker:

$$\frac{\partial E(I_2)}{\partial L_2^1} = -v_2 + \left(p_2 - f_2(v_2, d_2)\right)\frac{d_1 d_2 v_1^{\alpha} v_2^{\alpha} L_1^1}{(d_1 v_1^{\alpha} L_1^1 + d_2 v_2^{\alpha} L_2^1)^2} \qquad (15)$$

and $\frac{\partial E(I_2)}{\partial L_2^2} = -v_2 + \frac{\partial R_2}{\partial L_2^2} = 0$

The second order conditions are satisfied. [7]

Assuming an internal solution yields:

$$L_i^1 = \frac{v_i^{\alpha} v_j^{\alpha+1} d_i d_j \left(p_j - f_j\right)\left(p_i - f_i\right)^2}{\left(\left(p_i - f_i\right) d_i v_i^{\alpha} v_j + \left(p_j - f_j\right) d_j v_i v_j^{\alpha}\right)^2} \quad \forall \ i \neq j, \ i, j = 1, 2 \qquad (16)$$

We can now compute the probability of each individual winning the contest and climbing the rungs of the bank:

[7] Second order condition: $\frac{\partial^2 E(I_i)}{\partial (L_i^1)^2} < 0 \ \ and \ \ \frac{\partial^2 E(I_i)}{\partial (L_i^2)^2} < 0 \quad \forall i \neq j$.

$$\Pr ob_1(L_1^1,L_2^1)=\frac{d_1L_1^1v_1}{d_1L_1^1v_1+d_2L_2^1v_2}=\frac{d_1v_1^{\alpha-1}(p_1-f_1)}{d_1v_1^{\alpha-1}(p_1-f_1)+d_2v_2^{\alpha-1}(p_2-f_2)}$$

$$and \qquad (17)$$

$$\Pr ob_2(L_2^1,L_1^1)=\frac{d_2L_2^1v_2}{d_1L_1^1v_1+d_2L_2^1v_2}=\frac{d_2v_2^{\alpha-1}(p_2-f_2)}{d_1v_1^{\alpha-1}(p_1-f_1)+d_2v_2^{\alpha-1}(p_2-f_2)}$$

In order to gain a better understanding of the results, let us look at the weighted ratio of the rent seeking activities of both employees: $\left(\frac{d_1v_1}{d_2v_2}\right)\frac{L_1^1}{L_2^1}$. From equation (17), the weighted ratio of the values of rent seeking effort equals the ratio of the probabilities of wining the contest. An increase in the ratio means that the relative probability of candidate number 1 winning has increased.

$$\frac{\Pr ob_1(.)}{\Pr ob_2(.)}=\frac{d_1{v_1}^{\alpha-1}(p_1-f_1)}{d_2{v_2}^{\alpha-1}(p_2-f_2)}=\frac{d_1v_1}{d_2v_2}\frac{L_1^1}{L_2^1} \qquad (18)$$

The question is now: who has a higher probability of winning the privilege seeking contest? In answer to this question, we investigate whether the ratio defined in equation (18) increases or decreases with an increase in the productivity of one individual (v_1 or v_2) while holding the productivity of the other constant. We have:

(19)

$$\frac{d\left(\frac{d_1 v_1}{d_2 v_2}\frac{L_1}{L_2}\right)}{d v_1} =$$

$$= \left(\frac{1}{d_2 v_2^{\alpha-1}(p_2 - f_2)}\right)\left(\frac{\partial d_1}{\partial v_1} v_1^{\alpha-1}(p_1 - f_1) + d_1\left(\left(\frac{d p_1}{d v_1} - \frac{d f_1}{d v_1}\right) v_1^{\alpha-1} + (\alpha-1) v_1^{\alpha-2}(p_1 - f_1)\right)\right)$$

$$= \left(\frac{d_1 (p_1 - f_1) v_1^{\alpha-2}}{d_2 v_2^{\alpha-1}(p_2 - f_2)}\right)\left(\eta_{d,v} + \eta_{(p-f),v} + (\alpha - 1)\right)$$

which rests on the sign of:

$$\left(\eta_{d,v} + \eta_{(p-f),v} + (\alpha - 1)\right) \tag{20}$$

where $\eta_{d,v} = \frac{\partial d_1}{\partial v_1}\frac{v_1}{d_1}$ is the elasticity of the level of discrimination with respect to the level of productivity level, *v,* and $\eta_{(p-f),v} = \left(\frac{d(p_1 - f_1)}{d v_1}\frac{v_1}{(p_1 - f_1)}\right)$ is the full elasticity of a change in wages as a result of a change in the productivity level while climbing a rung. We now look at the full derivative of p_1 and f_1:

$$\frac{dp_1}{dv_1} = \frac{\partial p_1}{\partial v_1} + \frac{\partial p_1}{\partial d_1}\frac{\partial d_1}{\partial v_1} \quad and \quad \frac{df_1}{dv_1} = \frac{\partial f_1}{\partial v_1} + \frac{\partial f_1}{\partial d_1}\frac{\partial d_1}{\partial v_1} \tag{21}$$

Thus a change in the productivity level of a candidate effects directly the income that may be generated in both positions, $\frac{\partial p_1}{\partial v_1}$ *and* $\frac{\partial f_1}{\partial v_1}$, and in turn affects the ability of rent seeking. Changing the rent seeking abilities affects the income generated at the different positions, $\frac{\partial p_1}{\partial d_1}\frac{\partial d_1}{\partial v_1}$ *and* $\frac{\partial f_1}{\partial d_1}\frac{\partial d_1}{\partial v_1}$. From (21) we obtain:

$$\eta_{(p-f),v} = \left(\frac{\partial(p_1 - f_1)}{\partial v_1} + \frac{\partial d_1}{\partial v_1}\frac{\partial(p_1 - f_1)}{\partial d_1}\right)\frac{v_1}{(p_1 - f_1)} \tag{22}$$

In order to understand (20) let us divide our discussion into three parts. We first analyze the second component of (20) $(\eta_{(p-f),v})$ (which rests on the sign of $\left(\frac{\partial(p_1 - f_1)}{\partial v_1} + \frac{\partial d_1}{\partial v_1}\frac{\partial(p_1 - f_1)}{\partial d_1}\right)$), then look at the first component $(\eta_{d,v})$ and finally add the component $(\alpha - 1)$.

We now look at the second component: $\frac{\partial(p_1 - f_1)}{\partial v_1} + \frac{\partial d_1}{\partial v_1}\frac{\partial(p_1 - f_1)}{\partial d_1}$ and look at each of its own components examining its possible different signs:

1. $\frac{\partial(p_1 - f_1)}{\partial v_1}$ can be either positive or negative. If positive, this tells us that the more productive worker has a higher return on productivity on the second rung than on the first rung: $\frac{\partial p_1}{\partial v_1} > \frac{\partial f_1}{\partial v_1}$. However if negative then the return on the second rung is lower than the first.

2. $\frac{\partial d_1}{\partial v_1}$ the sign of this component determines the correlation between the productivity level of the worker and the ability to rent seek. If the productive workers have a higher ability in rent seeking, this derivative will be positive and if there is an inverse relationship between the productivity level of the worker and his ability to rent seek the derivative will be negative.

3. $\frac{\partial(p_1 - f_1)}{\partial d_1}$ this component tells us where a worker can get a higher return from rent seeking. If the worker can use his new position of the second rung to get a higher return on rent seeking than on the first rung, then this derivative will be positive.

Otherwise, if on the first rung it is easier to use his rent seeking abilities then the derivative will be negative.

In the following table we look at all three component together:

Table 1

CASE	$\frac{\partial(p_1 - f_1)}{\partial v_1}$	+ $\frac{\partial d_1}{\partial v_1}$	$\frac{\partial(p_1 - f_1)}{\partial d_1}$	TOTAL EFFECT
A	+	+	+	> 0
B	+	-	-	> 0
C	+	-	+	?
D	+	+	-	?
E	-	+	+	?
F	-	-	-	?
G	-	-	+	< 0
H	-	+	-	< 0

In cases A, B, C and D an increase in the productivity level of the worker has a larger effect on the direct income on the second rung than on the first rung. If there is a direct relation between the productivity level of the worker and his ability to rent seek and, at the same time, a worker with higher abilities to rent seek can take advantage of the new position in a better manner than in the first rung, then the total effect is positive (case A).

On the other hand, if there is an adverse relationship between productivity and the rent seeking ability, and rent seeking on the second rung is not as efficient as on the first rung, then the total effect will also be positive (case B).

In cases C and D it is not clear what the total effect is. From one side, the effect of productivity on the increase in income is positive, however, the effect of rent seeking is negative, either because there is a negative correlation between rent seeking and productivity or because the rent seeking opportunities are lower in the second rung.

In cases E, F, G and H an increase in the productivity level of the worker decreases his return to productivity when climbing the rungs of the bank. Given the effects of the second and third components, we see that the results change: In cases where it was previously unclear (cases C and D) we get a total negative effect (H and G) and in the cases in which it was previously positive (cases A and B) they become ambiguous (E and F). For example, in the case where all the workers on the second rung receive the same income regardless of their productivity and rent seeking levels, $p_i = p,$ then the first and third components will be negative. If, at the same time, there is an inverse relation between productivity and rent seeking abilities then the total effect will be negative.

For the time being let us disregard the other components of (20) [8]: The productive worker will win the contest and fill the position on the second rung if the increase in income from climbing the rungs of the bank is sufficiently high. In cases A and B it is clear that sufficient condition is that the effect of an increase in productivity is higher on the second rung of the bank than on the first rung and the second and third components have the same sign. In cases C and D, in order for the productive worker to win the contest the increase in income, from climbing the rungs of the bank as a result of an increase in the productivity level, has to be sufficiently high. Therefore it will have to cover the loss from the decrease in rent seeking abilities or possibilities. If the increase in income as a function of the productivity level of the worker is not sufficiently high (namely, the first component is positive though not high enough), the less productive workers will have the higher probability of winning the contest.

We can conclude that if the loss from rent seeking while climbing the rungs of the bank is greater than the increase in income, as a result of the increase in productivity, then the less productive workers will have the higher probability of winning the contest. The loss from rent seeking activities addresses the issues of: a. a negative correlation of rent seeking abilities and productivity together with an increasing ability to rent seek when climbing the rungs of the bank, or b. a positive correlation between rent seeking and the productivity level together with a negative correlation between

[8] Later on in the work we will incorporate this component.

the possibility of rent seeking and climbing the rungs of the bank. When climbing the rungs of the bank both options state that when productivity increases the income attributed to rent seeking decreases.

Let us consider the following case: $p_1 = p_2$ $\left(p_1 = p_2 > Max\{v_2, v_1\}\right)$ and there is an inverse relationship between the productivity of the candidate and his ability to rent-seek (case H). The income on the second rung is independent of his/her level of productivity and rent seeking abilities. We can conclude that

Less productive employees invest more time in rent seeking activities and have a higher probability of being the president of a public bank.

This result is somewhat similar to the result presented in Epstein, Hillman and Ursprung (1999). The authors present a one period model where a contest takes place in order to win a prize. Investment, in order to affect the outcome of the contest, depends on time consumption and thus is a function of the contestants' productivity levels. The prize is fixed and equal for all contestants. The authors show that the less productive invest more time in privilege seeking activities and so have a higher probability of winning the contest.

A sufficient condition for an efficient worker to win the contest is *that* $\frac{\partial(p_1 - f_1)}{\partial v_1} > Min\left\{0, -\frac{\partial d_1}{\partial v_1}\frac{\partial(p_1 - f_1)}{\partial d_1}\right\}$. *Namely, that the increase in income as a result of an increase in productivity will be greater than the effect an increase in productivity has on the rent seeking abilities.*

If $\frac{\partial d_1}{\partial v_1}\frac{\partial(p_1 - f_1)}{\partial d_1} > 0$ then a sufficient condition is simply that the effect an increase in productivity has on the wage for the second rung is higher than the effect it has on the wage for the first rung.

We see that, if there is a loss in rent seeking abilities when climbing the rungs of the bank then in order for a productive worker to get to the post on the second rung, the increase in wage must be sufficiently high. It is not clear that the bank can afford to increase the wages to such an extent as to enable the productive worker to win the contest. On the other hand, the result obtained is *that if the wages are not sufficiently high we may see productive workers on the second rung of the bank though these workers have high abilities in rent seeking.* It cannot be said that this is good for the bank. Thus if the bank wants to attract the productive workers with low rent seeking abilities it must increase the wages to a sufficiently high level.

Let us now return and look at the whole problem, i.e. all of (20):

$$\left(\eta_{d,v} + \eta_{(p-f),v} + (\alpha - 1)\right) \qquad (20')$$

We have analyzed the sign of the second component of (20') seeing the condition under which it is positive or negative. Let us now add the first component in order to get the full analysis. If the sign of both components are identical then the analysis presented above holds. However, if the signs of the components have opposite directions then it is not clear what the outcome will be. For example, if the bank wants the productive worker to have the higher probability of winning the contest and the first component has a negative sign, then the increase in wages must be even higher than was described in the analyses above. Thus this extra component may make it harder for the productive worker to win the contest. Now adding the final component: $(\alpha - 1)$. As the value of α the employer has more knowledge regarding the workers productivity level and thus it is easer for him to promote the productive worker. If for example $(\alpha = \infty)$then it is clear that the productive worker will be promoted. Otherwise it is not clear that the productive worker will be promoted.

Let us now look at the effect, given an increase in the information the employer has about the workers productivity, on the total promotion seeking activities in the bank: $\frac{d\left(L_1^1+L_2^1\right)}{d\alpha}$. Using (16) we obtain:

$$\frac{d\left(L_1^1+L_2^1\right)}{d\alpha}=-B\left[d_2 v_2^{\alpha-1}\left(p_2-f_2\right)-d_1 v_1^{\alpha-1}\left(p_1-f_1\right)\right]\left[Log\left(v_2\right)-Log\left(v_1\right)\right] \qquad (23)$$

where

$$B=\frac{\left(p_1-f_1\right)\left(p_2-f_2\right)v_1^{\alpha+1}v_2^{\alpha+1}\left(\left(p_1-f_1\right)v_2+\left(p_2-f_2\right)v_1\right)}{\left(d_1 v_1^{\alpha}v_2\left(p_1-f_1\right)+d_2 v_1 v_2^{\alpha}\left(p_2-f_2\right)\right)^3}>0$$

Without loss of generality assume that $v_1>v_2$ thus

$$\frac{d\left(L_1^1+L_2^1\right)}{d\alpha}\ \substack{<\\>}\ 0 \text{ iff } \left(\frac{v_2}{v_1}\right)^{\alpha-1}\ \substack{<\\>}\ \frac{\left(p_1-f_1\right)d_1}{\left(p_2-f_2\right)d_2} \qquad (24)$$

Notice that $\left(\frac{v_2}{v_1}\right)^{\alpha-1}<1$ and even that $p_1>p_2$ it is not clear the direction of (24). If the productive worker gets an increase in wages from one rung to the other while the other worker is very efficient in promotion seeking activities, the total amount of resources spent on promotion seeking activities would increase with the increase of the manager's information. The reason for this is that the less productive worker will have to disguise his productivity level even more under the new situation. However, if the increase of wages from one rung to the other for the productive worker is sufficiently high (relative to that of the low productive worker) then the total investment in promotion activities will decrease. Moreover, as the information level increases there is a higher probability that the total investment will decrease.

From (24) we can conclude that

$$\frac{d\left(L_1^1 + L_2^1\right)}{d\alpha} < 0 \quad \text{iff} \quad \alpha > 1 + \frac{Ln\left[\dfrac{(p_1 - f_1)d_1}{(p_2 - f_2)d_2}\right]}{Ln\left[\dfrac{v_2}{v_1}\right]} \tag{25}$$

Thus it is clear that if the productive worker is a better promotion seeker or has a sufficient increase in wages from one rung to the other then increasing the manager's information regarding his employee's productivity level will decrease the total investment in promotion seeking activities. Otherwise, total investment in promotion seeking activities may increase. However, if the level of information is sufficiently high then total investment will decrease.

To conclude:

1. *In order for the productive worker with low rent seeking abilities to have a high probability of winning the contest, the increase in wages from one rung to the other must be sufficiently high.*
2. *If the increase in wages is high but not high enough, then the less productive worker or the productive worker with the high rent seeking abilities will have the higher probability of wining the contest.*
3. *In order to ensure that the productive workers have a high probability of winning the contest, the increase in wages from one rung to the other can be smaller, as the information the employer has regarding the workers' productivity level increases.*

The intuition behind this result is that productive workers have a higher opportunity cost when competing. They need the prize to be sufficiently high so that the *expected prize* will compensate for their cost of competing in the contest. The cost of competing is the loss of current income as a result of investing less time in productive activities. As the worker is more productive his cost in terms of lost income increases. If the worker is productive and has high rent seeking abilities it will be easier to entice him, via increase in income, as he has other ways to increase his income. However, if the worker is productive and has low rent seeking abilities, the expected prize must be sufficiently high, meaning that the increase in income must be sufficiently high for this worker to have a low participation in the contest. This result is not straightforward. Increasing the wages from one rung to the other stimulates all the workers, regardless of their productivity level, to increase their investment in the contest. Thus it is not clear that the winning probability of the productive workers will increase. The prize, at its different levels, increases the investment of the less productive workers - however it only increases the investment of the productive workers if the expected prize is sufficiently high and compensates the worker for his loss in participating in the contest.

It is not clear that the bank can afford an increase in wages that will increase the winning probability of the productive worker with low rent seeking abilities.

4. Conclusions

This paper considered the case under which the workers in a bank can engage in rent seeking activities in order to increase their income and climb the rungs of the bank's ladder. Employers may or may not design such political contests, however the workers may well believe that such contests exists (see Cleveland and Murphy, 1992, Altman, Vanlenzi and Hodgetts, 1985 and Tziner 1999). We have investigated who is promoted to senior management of a bank, and whether in particular there is adverse selection in the promotion contests. If the rewards from climbing the ladder in the hierarchy of the bank are high but not high enough, less productive employees or productive workers with high rent seeking abilities will be on higher rungs of the bank. In such a case this will reduce efficiency and decrease rents available to be divided among the employees climbing the internal promotion ladder. The intuition behind the result is that productive workers have a higher opportunity cost when competing. Thus they need the prize to be sufficiently high so that it will compensate for their cost of competing in the contest. This result is not straightforward. Increasing the wages from one rung to the other stimulates all workers, regardless of their productivity level, to increase their investment in the contest. The prize, at its different levels, increases the investment of the less productive workers. However it only increases the investment of the productive workers if the expected prize is sufficiently high.

As the employer has more information regarding the productivity levels of the workers, the increase needed in wages from one rung to the other, in order to increase the winning probability of the productive workers, decreases. The main idea behind this result is that if the employer has no knowledge whatsoever regarding the productive level of the workers, the probability that the productive worker will win the contest is smaller than in the same situation when the employer has some information regarding the levels of productivity. Thus, the expected prize of the productive worker has decreased while the expected prize of the less productive worker has increased.

References

Alman S. Valenzi, E. and Hodgetts R.M. (1985), *Organization Behavior: Theory and Practice,* Academic Press, Orlando, FL.

Altonji, J. G. and Pierret C. R. (1999) "Employer Learning and Statistical Discrimination" unpublished manuscript, Northwestern University.

Bauer T. K. and Hasken-DeNew J. P . (2000) "employer Learning and the returns to Schooling", IZA discussion paper no 146.

Beckmann, M. J. (1978), *Rank in Organizations*, Berlin: Springer-Verlag.

Cleveland J. N. and Murphy K.R. (1992) "Analyzing Performance Appraisal as Goal-Directed Behavior" *Research in Personnel and Human Resources Manage*ment, 10, 121-185.

Epstein, G. S., (1996) "Changing a Decision Taken Under Incomplete Information During the Process of Execution", *Journal of Economic Behavior and Organization*, Vol. 29, pp. 323-329.

Epstein, G. S., Hillman A. L. and Ursprung H. W. (1999) "The King Never Emigrates", *Review of Development Economics*, 3(2), pp. 107-121.

Epstein, G. S. and Spiegel, U. (1997), "Monitoring within the Bank and Manager Relations", *International Journal of the Economics of Business*, 4(1), pp. 51-62.

Epstein, G. S. and Spiegel, U. (2001), "Natural Inequality , Productivity and Economic Growth", *Journal of Labour Economics*, 8, 463-473.

Farber, H. S. and Gibbons R. (1996) "Learning and Wage Dynamics" Quarterly Journal of Economics, 111 pp. 1007-1047.

Hillman, A.L. and Riley, J.G. (1989), "Politically Contestable Rents and Transfers", *Economics and Politics*, 1, 17-39.

Hillman, A.L. and Katz, E. (1987), "Hierarchical Structure and the Social Costs of Bribes and Transfers", *Journal of Public* Economics, pp. 129-142.

Hirshleifer, J. (1989), "Conflict and Rent Seeking Success functions: Ratio Vs Difference Model of Relative Success" *Public Choice*, pp. 101-112.

Lazear, E.P. (1996), *Personnel Economics,* MIT Press Cambridge, second addition.

Lazear, E.P. and Rosen, S. (1981), "Rank-Order Tournaments as Optimum Labor Contracts", *Journal of Political Economy,* 89(5), pp. 841-64.

Luce, R.D. (1959) *Individual Choice Behavior: A Theoretical Analysis* (Wiley).

Milgrom, P. R. and Roberts, J. (1992), *Economics, Organization and Management,* Prentice Hall.

Radner, R. (1993), "Hierarchy: The Economics of Managing", *Journal of Economic Literature*, pp. 1382-1415.

Rosen S. (1986), "Prizes and incentives in Elimination Tournaments", *The American Economic Review*, 76(4), pp. 701-715.

Sheshinski, E. (2000), "Bounded Rationality and Social Optimal Limits on Choice: An Example" Hebrew University Jerusalem.

Tullock, G. (1980), "Efficient Rent Seeking" In J.M. Buchanan, R.D. Tollison, and G. Tullock, editors, *Toward a Theory of the Rent Seeking Society* (Texas A@T Press, College Station TX).

Tversky, A. (1969), "Intransitivity and Preferences" *Psychological Review*, 76, pp. 31-48.

Tversky, A. (1972), "Elimination by Aspects: A Theory of Choice" *Psychological Review*, 79, pp. 281-299.

Tziner A. (1999) "The relationship Between Distal and Proximal Factors and the Use of Political Considerations in Performance Appraisal", *Journal of Business and Psychology*, 14 91) 217- 231.

Tziner A., Latham, G.P., Prince, B.S. and Haccoum, R.R. (1996) "Development and Validation of a Questionnaire for Measuring Political Considerations in Performance Appraisal" *Journal of Organization Behavior,* 17 179-190.

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