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Bureaucracy

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Max Weber extolled the hierarchic-bureaucratic mode of organization: “Experience” - he claimed - “tends universally to show that the purely bureaucratic type of administrative organization... is, from a purely technical point of view, capable of attaining the highest degree of efficiency” (Weber, 1947, p. 337).

Since Weber’s time business and government bureaucracy has flourished . Between 1900 and 1950 the ratio of administrative personnel to production workers in U.S. industry grew from 10 per cent to 20 per cent (Bendix, 1956, p. 214)¹ By 1983 it reached 48 per cent (Meyer, 1985, p. 37). The proportion of government employees (most of whom are bureaucrats) in the civilian labor force rose in the post-World War II period from 10 to 16 per cent. (Meyer 1985 p. 37) A similar trend is noted throughout the industrialized world.

Yet , far from being admired, bureaucrats – especially those working for the government- are looked upon as “permanently bungling and inefficient individuals or, alternately, [as] individuals who carry out only those decisions that serve their own interests, rather than those of their superiors”(Breton and Wintrobe, 1982 pp. 6-7) But, “however much people complain about the ‘evils of bureaucracy’ it would be sheer illusion to think for a moment that continuous administrative work can be carried out in any field except by means of officials working in offices. The whole pattern of everyday

¹ Bendix (1956) computed three indices of bureaucratization: (1) The ratio of salaried employees to total employment, (2) The ratio of administrative personnel to production workers and (3) the ratio of salaried personnel to the business elite (CEOs, etc.). All three ratios displayed similar trends.

life is cut to fit this framework” (Weber, 1947, p.337) Out of power politicians pledge that, if elected, they will curb the bureaucracy, but, when in office they seem unwilling or incapable to carry out their promise.

Our goal is to reconcile Weber’s claims in favor of bureaucracy with the arguments of the critics. The discussion is organized as follows. In Section 1 we present Weber’s case in favor of a bureaucratic mode of organization. Section 2 gives a brief description of major inquiries into the functioning of hierarchies. In Section 3 we present a simple model of an efficient Weberian bureaucracy. The Principal – Agent problem confronting profit-oriented enterprises is discussed in Section 4; section 5 discusses the additional difficulties confronting public sector Bureaus. Niskanen’s hypothesis of a bureau-maximizing bureaucracy, and of bureaucracy-maximizing politicians is examined in Section 6. The seventh section is devoted to the issue of efficiency vs. loyalty of bureaucratic employees. The last section contains a brief summary of the major conclusions.

1. Max Weber’s concept of bureaucracy

Max Weber saw bureaucratization as the natural consequence of the development of socio-economic systems in which “every body of law consists essentially in a consistent system of abstract rules”. Individuals in authority apply these rules “in the rational pursuit of the interests which are specified in the order governing the corporate group” (Weber, 1947 p. 330).

“Modern officialdom”, says Weber, ”functions in the following specific manner:

1. There is the principle of fixed and official jurisdictional areas, which are generally ordered by rules, that is by laws or administrative regulations
2. The authority to give commands required for the discharge of these duties is... strictly defined by rules concerning the coercive means... which may be placed at the disposal of the officials
- 3...[O]nly persons who have generally regulated qualifications are employed

In public and lawful government these three elements constitute ‘bureaucratic authority’. In private economic domination they constitute bureaucratic ‘management’” (Weber, 1946, p. 196)

The term “bureaucracy” is often associated with public administration, but “[t]he principle of hierarchical office authority is found in all bureaucratic structures :in state and ecclesiastical structures as well as in large party organizations and private enterprises. It does not matter whether its authority is called ‘private’ or ‘public’” (Weber, 1946 p. 197) Moreover, the larger the organization, the greater the role of the bureaucracy (ibid. p. 334)

Efficiency calls for hierarchic organization : “The principles of office hierarchy and of levels of graded authority means a firmly ordered system of super- and subordination in which there is a supervision of the lower offices by the higher ones (Weber, 1946 p. 197)” A bureaucrat working within a hierarchic organization is “chained to his activity by his entire material and ideal existence” Bureaucrats “have a common interest in seeing that the mechanism continues its function” (1946, pp. 228-229). The acceptance of a bureaucratic post presupposes loyalty: “Entrance into an office, including one in the private economy, is considered an acceptance of specific obligations of faithful management in return for a secure existence” (1946, p. 199). Loyalty is essential for the good functioning of bureaus, for, “If the official stops working, or if his

work is forcefully interrupted, chaos results, and it is difficult to improvise replacements from among the governed who are fit to master such chaos” (1946, p. 229)

Bureaucrats are professionals, “remunerated by fixed salaries... The salary scale is primarily graded according to rank in the hierarchy; but in addition to this criterion, the responsibility of the position and the requirements of the incumbent’s social status may be taken into account” (1947, pp. 333-334)² The fixed salary system is superior to alternate forms of remuneration: “According to experience, the relative optimum for the success... of the bureaucratic apparatus is offered by a secure money salary that is connected with the opportunity of a career that is not dependent upon mere accident or arbitrariness”. Moreover, “it is a matter of principle that the members of the administrative staff should be completely separated from ownership of the means of production or administration” (1947 p. 331)

The superiority of the bureaucratic-hierarchic mode of organization lies in the “exercise of control on the basis of knowledge. This is the feature which makes it specifically rational”. Knowledge includes “technical knowledge which, by itself, is sufficient to ensure a position of extraordinary power” and also “knowledge growing out of experience in the service” (1947, p. 339). “[O]nly a person who has demonstrated an adequate technical training is qualified to be a member of the administrative staff” (1947, p.331). “Individual performances are allocated to functionaries who have specialized training and who by constant practice learn more and more” (1946 p. 215) Knowledge is

² Elsewhere (1946, p. 203) Weber states that “The salary is not measured like a wage in terms of work done, but according to ‘status’, that is, according to the kind of function (the ‘rank’) and, in addition, possibly, according to length of service”

power, hence “Every bureaucracy seeks to increase the superiority of the professionally informed by keeping their knowledge and intentions secret”(1946, p. 233)

2. Models of hierarchic systems

The formal study of hierarchic structures was initiated by Oliver Williamson. (1967). Williamson assumed that the head of an enterprise is endowed with superior knowledge which is passed, in the form of orders, to lower levels of the hierarchy, and, ultimately to the production workers. “[O]nly a fraction α ($0 < \alpha < 1$) of the intentions of the superior are effectively satisfied by a subordinate”, hence “control loss is strictly cumulative... across successive hierarchic levels”(Williamson, 1967 p. 127) As a consequence, the efficiency of the production workers is proportional to α^n where n is the number of hierarchic levels. Williamson demonstrated that if $\alpha = 1$ (i.e. in the no-loss-of-control case), the number of hierarchic layers does not set a limit to firm size. For $\alpha < 1$, however, the greater the degree of loss of control (i.e. the smaller the α) the lower the firm size limit.³

Williamson’s paper stimulated far-ranging research into the structure and the characteristics of hierarchic-bureaucratic organizations. Calvo and Wellisz (1978) demonstrated that full effort can be elicited from the employees if they are offered an appropriate “package” of reward for work – punishment of shirking . The closeness of effort monitoring, they assumed, is a declining function of the number of supervisees per supervisor, hence, as the ratio rises, the probability of an employee being caught shirking declines. To insure that the employees give full effort, it is necessary, therefore to raise the reward for work At a certain point (defined as the Span of Control”) it is less costly

³ A formal proof of the proposition that the limit of the efficient size of the hierarchy depends crucially on the loss-of-control assumption was given by Mirrlees (1976) and by Calvo (1977)).

to interpose between the “boss” and the workers a supervisory layer, and the same holds true for further expansion. Calvo and Wellisz demonstrated that if it is profitable to build a two-layer (“boss” + production workers) organization, then the larger enterprise, (hence the larger the number of hierarchic layers) the greater the ultimate claimant’s rent. Thus “loss of control”, defined in terms of on-the job shirking is preventable, and it does not limit the size of the enterprise.

Keren and Levhari (1979) look at a hierarchic firm as a problem-solving machine. They take “a productive structure of given size has come into being and that a superstructure has to be set up to prepare for a coordinated plan of action” (1979, p. 1163). The assumption is that the members of each hierarchic level work concurrently, while members of the immediately superior or inferior level await the outcome of their work and start when the adjacent level has finished. Delay in time completion is costly, but the costs also rise as the number of non-production workers increases. Keren and Levhari show the relation between the cost of time, the wage level, and the optimal ratio of supervisees/supervisor at each hierarchic level.

Qian (1994) provides a general solution to the organizational design problem of a hierarchy. He takes as a datum the state of the technology and the capital stock of an enterprise, and provides a simultaneous solution for the optimal number of hierarchic levels, the span of control, and the wage scale. Qian shows that on the optimal hierarchy in which all managers and workers are identical *ex ante*, wages fall and efforts decrease as one moves from top to bottom of a hierarchy; as the size of the hierarchy increases,

both efforts and wages of managers at the top increase because their marginal product increases (Qian, 1994, p. 528)

Two recent papers Garicano (2000) and Beggs (2000) address the problem of utilization of knowledge in a hierarchic organization. Garicano looks at hierarchies as devices to reduce the cost of acquisition of specialized knowledge:

“Workers can learn the solution to the problems they confront at a cost... A worker in autarchy ... learns the most frequent problems and ignores the rest... Organization allows different workers to acquire different knowledge sets and communicate knowledge as required. This has two advantages: first, it allows workers to increase the utilization rate of knowledge, decreasing the per capita learning cost; second, it allows more knowledge to be acquired and used in solving problems. But it also incurs two new costs: matching the problem with the workers who know it and communicating the answer” Garicano (2000) p.878).

Knowledge-acquisition costs are reduced if the enterprise is organized in a hierarchical fashion:

“If communication is available, workers do not need to acquire all the knowledge necessary to produce. Instead, they may acquire only the most relevant knowledge and, when confronted with a problem they cannot solve, ask someone else. The organization must then decide who must learn what and whom each worker should ask when confronted with an unknown problem” (ibid. p.875)

“Production know-how is...often... “embodied” in individuals. [I]n this case, it is natural to organize knowledge as a “knowledge-based hierarchy”. In such a structure, knowledge of solutions to most common or easiest problems is located in the production floor, whereas knowledge about more exceptional or harder problems is located in higher levels. Production workers learn how to solve the most common and the easiest problems. The more exceptional and the harder problems are solved at successively higher hierarchic levels (“management by exception”).

Any individual's time, hence his problem-solving capacity, is limited. "By adding layers of problem solvers, the organization increases the utilization rate of knowledge, thus economizing on knowledge acquisition, at the cost of increasing the communication required. The limited availability of time counters the returns arising from fixed costs, resulting in a limited span of control of problem solvers" (ibid. 875)

Beggs addresses the problem of hierarchic allocation of workers who differ in ability where "Abler workers are capable of making (good) decisions in a wider range of tasks than less able ones" (Beggs, 2000 p. 297) An organization can reduce costs by employing unskilled workers for routine tasks. But problems which low-skill workers cannot solve have to be passed on to higher-skill individuals, causing (costly) delays. Beggs applies the queuing theory to investigate the relation between the cost of delays, as well as the effect of the wage structure and of the range of tasks on the optimal structure of the hierarchy. He proves, *inter alia*, that (1) higher levels of organization have fewer workers than lower ones (2) that it pays to place the more able workers on higher hierarchic levels. Thus from the point of view of the residual claimant (who may not be a member of the hierarchy), it is rational to give the most able individual the position of the "boss".

3. A simple Weberian model

We propose to present a very parsimonious model that displays the advantages which Weber claimed for a rationally organized bureaucracy, and, in particular for his

claim of rational use, rather than rational acquisition, of knowledge. In our scheme superiors issue orders to their immediate subordinates. In the spirit of Weber we assume that the recipients strive to execute the orders, but how well they execute them, depends on their qualifications. We investigate under what conditions it is profitable for an Agent to become a head of a hierarchic organization, rather than to be an employee or to be self-employed. We demonstrate that it never pays for the head of a hierarchy to hire individuals with higher qualifications than his own, and that it is rational to place the more qualified individuals on the higher rungs of a hierarchy.

Let there be an economy in which the agents have the choice of (i) self-employment, (ii) of being employed by a hierarchic enterprise as a worker or as a bureaucrat or (iii) of heading an enterprise. An Agent cannot have more than one occupation. All work is equally onerous and psychically equally rewarding, hence in choosing between any two occupations, an Agent will rationally choose the one which yields the higher utility of income⁴.

We shall use the term hierarchy, as defined by Radner, to denote a ranked tree, where:

“A Tree is a collection of objects, together with a relation among them, to be called here “superior to”. This relation has the following properties: 1. Transitivity - if A is superior to B, and B is superior to C, then A is superior to C, 2. Antisymmetry - if A is superior to B, then B is not superior to A. 3 That is exactly one object called the *root*, that is superior to all the other objects. 4. Except for the root [i.e. the head of the hierarchic organization], every object has exactly one superior” (Radner, 1992 p. 1390)

⁴ Activities (i) and (ii) may call for a capital investment, but we assume that the financial market is perfectly competitive, that all investments are risk-less, and there is no moral hazard, hence we do not have to take into account any financial considerations.

Rank is assigned in the following manner:

“1. If A is superior to B then it has a higher rank 2. If A and B have the same rank, then they are comparable, i.e. A is not superior to B, nor is B superior to A” (*Ibid.* p. 1391).

The higher ranking individuals issue orders to the lower-ranking ones, who are supposed to execute their superiors' directives.

We shall define as bureaucrats the individuals who occupy intermediate positions between the decision maker (the entrepreneur, the boss) and the workers⁵. Bureaucrats are, at once, subordinates and superiors. The top-ranking ones are directly responsible to the decision-makers; those at the bottom are in direct control of the workers. The role of the bureaucrats is to monitor and coordinate the activities of their immediate subordinates, to transfer to lower layers the orders of the decision-makers, and to transmit information signals to their superiors. Bureaucrats also have decision-making functions:

“Information from the field flowing up to the decision makers at the apex of the bureau must be synthesized by lower- level bureaucrats so that only the most relevant information moves upward and in condensed form, Similarly, commands flowing down tend to be very general at first. It is the task of those at lower levels to interpret these commands, flesh them out, make them specific, and apply them to concrete problems”

⁵ The terms “bureau” and “bureaucrat” are applied differently by different authors. For Von Mises “Bureaucratic management is the method applied to the conduct of administrative affairs the result of which has no cash value in the market”(Von Mises, 1944, p. 47) Niskanen defines bureaus as “those organizations which have *both* of the following characteristics: 1. The owners and employees of these organizations do not appropriate any part of the difference between revenues and costs as personal income 2 Some part of the recurring revenues of the organization derive from other than the sale of output at a per-unit rate” (Niskanen, 1994 p.15) At times he applies the term “bureaucrat” “to define any full-time employee of a bureau”. For the most part, however, he uses the term “to define the senior official of any bureau with a separate identifiable budget” (*ibid.* 22), Niskanen acknowledges, however, that “From Weber to Galbraith... “bureaucracy” has been used by many scholars in reference to all large modern organizations (*ibid.* p. 23)

(Breton and Wintrobe 1982 p.39)

The need for bureaucracy arises out of the limits of the head of an organization's capacity for decision-making. Decision-making requires time. In a small organization the boss is able to direct the performance of all his employees. But as the size and the complexity of the enterprise increases, the "boss" has less and less time to devote to any problem. As a consequence, the proportion of "right" decision declines⁶. At some point the "boss" has to decide whether to forego further expansion, or to delegate some decision tasks to a lower hierarchic level. To simplify the exposition, and without loss of generality, we shall assume that the effectiveness of decision-making is invariant for n , the supervisee/supervisor ratio less than or equal to n^* , and that it falls discontinuously if the ratio rises to (n^*+1) . We shall call n^* the span of control.

Economic Agents can be characterized in terms of their "competence" or "skills" or "qualifications"- expressions which we shall use as synonyms for Weber's "technological knowledge". The level of competence depends on an Agent's inborn ability, diligence, education, and on other factors, such as the length of work experience. The level of competence will be indicated by a subscript, with 0 indicating the highest level, and higher digits successively lower levels. When working in isolation, an Agent of type A_i produces a_i . Competence is completely generalized: If an Agent of type A_i is β times more efficient than Agent of type A_j at some task x , he is β times more efficient than agent A_j at any other task x' . We can think of effectiveness and of efficiency in terms of binary ("right" or "wrong") decisions. All Agents are capable of making the same number of decisions per unit time, but they differ in terms of the (expected)

⁶ For a discussion of limited attention as a determinant of the span of control, see Gifford (1992)

right/wrong decision ratio. All right (wrong) decisions made on a given hierarchic level counting from the bottom have the same positive (negative) payoffs

The effectiveness of the Agents employed in hierarchic organizations depends on their own competence, as well as on the effectiveness of their superiors. The effectiveness of platoon commander depends on his courage and ability, but also on the commands he receives from his superior officer – and ultimately from on the competence of the Head of the Armed Forces. In business the effectiveness of a salesman depends on his skill, but also on the effectiveness of the branch sales manager, whose effectiveness, in turn, reflects on his own capability, and that of the head of marketing – and, ultimately on the skills of the CEO.

We shall indicate by a_{ij} the effectiveness of an A_j – type Agent working under an A_i – type supervisor. The magnitude of the a_{ij} coefficient depends on the degree of pass-through of skill. In the general case $a_i \geq a_{ij} \geq a_j$ for all $j \geq i$ ($i, j = m, \dots, 1, 0$) When pass-through is complete, $a_{ij} = a_i$; if no skill is transferred $a_{ij} = a_j$. The higher the effectiveness of the supervisor, the greater the pass-through of skill to his supervises, so that $\partial a_{ij} / \partial a_i > 0$. Given the supervisor's effectiveness, the higher the supervisees' qualifications, the greater his effectiveness as a hierarchic employee, hence $a_{ij} > a_{ik}$ for all $k > j$ ⁷. We shall assume that the “skills” that are passed through within an organization are specific to that organization. Thus as long as an A_j – type Agent works as a subordinate of an A_i – type

⁷ This assumption is also made by Qian (1994). In his scheme, however, (as in Calvo-Wellisz, 1978) the head of the organization is the only one endowed with superior knowledge, while all other members of a hierarchic organization are identical

Agent, his effectiveness is a_{ij} , but once he quits his job, his level of qualification reverts to a_i .⁸

In a profit-oriented hierarchic structure an entrepreneur earns a rent $R = Q - W$, where Q is the value of the output and W the wage bill. In a two-level organization, in which an A_i entrepreneur supervises n A_j -type production workers (where $A_i =$ or $\neq A_j$) the entrepreneur's rent can be written as:

$$R_{ij} = n*(a_{ij} - w_j) \quad (1)$$

To attract employees, the wage w_j offered to A_j -type Agents has to be at least as high as their self-employment opportunity cost. The profit-maximizing entrepreneur offers the lowest wage compatible with the participation constraint, hence, if some A_k -types are self-employed, then $w_j = a_j$, and (1) can be re-written to read:

$$R_{ij} = n*(a_{ij} - a_j) \quad (1a)$$

We can now demonstrate the following propositions:

1. An Economic Agent becomes an entrepreneur if his rent is at least equal to the wage he could earn as a worker or a bureaucrat, or at least equal to his self-employment earnings, whichever is higher.

The proof is immediate. Since all tasks are equally difficult and all bring the same psychic utility, an A_i -type Agent will become the head of a business if and only if

$$R_{ij} \geq a_i \text{ if } a_i \geq a_{xi} \text{ and } R_{ij} \geq a_{xi} \text{ if } a_i \leq a_{xi} \text{ for any } a_{xi}$$

⁸ A similar assumption is made by Rajan and Zingales in whose scheme "Because superiors assign subordinates tasks to complement their own skills, managers [intermediate level employees] once specialized, are useless without their superior and can produce only in a team that contains the superior" However in their scheme managers who interact directly with the principal can partially appropriate his technology (Rajan and Zingales 2002, p. 808) while we rule out the possibility of such appropriation.

2. It does not pay for an individual to organize an enterprise and to hire personnel with equal or higher qualifications than his own.

Let an A_j -type (try to) organize an enterprise, and hire A_j -type workers, where $a_i \geq a_j$. To attract the employees, the wage he offers must be at least as high as their opportunity cost. Since the opportunity cost of A_i type individuals is equal or greater than their self-employment earnings a_i ,⁹ it follows that: $w_i \geq a_i$. Writing R_{ji} for the entrepreneurial rent accruing to a A_j -type boss who hires n^* employees each of whom has an “inherent efficiency” a_i and commands a wage $w_i = a_i$, we get:

$$R_{ji} = n^*(a_{ji} - w_i).$$

But $a_{ji} \leq a_i$, while $w_i \geq a_i$, hence $R_{ji} \leq 0$ (with inequality for $j > i$, and equality for $j = i$).

The prospective entrepreneur would earn zero rent if his employees had qualifications equal to his, and a negative rent if he a negative rent if they were more qualified.

3. An A_i type Agent would gain by organizing an enterprise and by hiring n^* employees who are less qualified than he is if the pass-through of competence is so high, that the value of output of the enterprise net of wages paid to the employees at opportunity cost exceeds the Agent's opportunity cost.

4. The entrepreneur's (net) rent ($R_{ij} - a_i$), over and above his self-employment opportunity cost is the higher, the higher the larger the span of control n^* , and the greater the difference between the effectiveness of an A_j type worker supervised by an A_i -type superior, and the A_j productivity in self-employment..

Again, the proof is immediate. Write

⁹ The opportunity cost of A_i -type agents equals a_i when some such agents are self-employed, but it may be higher if all such agents are either heads of employees of hierarchic enterprises.

$$R_{ij} = n^*(a_{ij} - w_j) \geq a_i \quad (2)$$

where R_{ij} is the rent accruing to the A_i -type entrepreneur who employs n^* A_j -type workers. If some A_j -types are self-employed, then $w_j = a_j$, the entrepreneurial rent can be expressed as:

$$R_{ij} = n^*(a_{ij} - a_j) \geq a_i \quad (2a)$$

It is obvious that R_{ij} increases in n^* and in $(a_{ij} - a_j)$

5. The advantage of a m -tier over an $(m-1)$ -tier organization is the greater, the greater the span of control, the higher the pass-through of competence, the greater the difference between the qualifications of the head of the enterprise and his employees, and the lower the opportunity cost of the latter.

Consider the problem facing the head of an enterprise who personally supervises n^* workers. To expand his enterprise, the “boss” would have to interpose a level of bureaucratic employees between himself and the workers. Assuming the constancy of the span of control across the levels¹⁰, the entrepreneur could supervise n^* bureaucrats, and each bureaucrat could supervise n^* workers. The number of production workers would grow from n^* to n^{*2} . If the bureaucrats are of the A_j -type, while the workers are of the A_k type (where $A_j =$ or $\neq A_k$) production will be equal $n^{*2} a_{ijk}$, where a_{ijk} stands for the productivity of an A_k type worker working under the supervision of an A_j type bureaucrat responsible to an A_i type boss. We can express the entrepreneurial rent from a 3-level

¹⁰. Calvo and Wellisz (1979) and Holmstrom and Tirole (1988) assume that the number of layers is limited by a binding constraint, in which case the lower the level, the smaller the span of control. Qian (1994) has shown that in the continuous case the endogenously determined optimal span of control is constant across the hierarchic layers provided the number of layers is not predetermined

organization as:

$$R_{ijk} = n^{*2} a_{ijk} - (n^* w_j + n^{*2} w_k). \quad (3)$$

Assuming that some of the A_j and A_k type individuals are self-employed, the above can be re-written as:

$$R_{ijk} = n^{*2} a_{ijk} - (n^* a_j + n^{*2} a_k) \quad (3a)$$

Subtracting (2a) from (3a) we get as a condition of profitability of expansion from a 2-tier to a 3-tier hierarchy

$$n^*(a_{ijk} - a_k) - a_{ij} \geq 0$$

The meaning of the above condition becomes clearer if we consider the case of a specific pass-through function Let us assume that:

$$a_{ij} = \alpha a_i + (1 - \alpha) a_j \quad (4)$$

from which:

$$a_{ijk} = \alpha^2 a_i + \alpha(1 - \alpha) a_j + (1 + \alpha) a_k \quad (5)$$

If the enterprise head is of type A_0 , while the labor force is homogenous we can write

$$a_i = a_0 \text{ and } a_j = a_k = a_1, \text{ then}$$

$$R_{011} = n^{*2} [\alpha^2 a_0 + \alpha(1 - \alpha) a_1 + (1 + \alpha) a_1] - (n^{*2} + n^*) a_1 =$$

$$= n^{*2} \alpha^2 a_0 - n^2 \alpha^2 a_1 - n^* a_1$$

while

$$R_{01} = n^* [\alpha a_0 + (1 - \alpha) a_1] - n^* a_1 = n^* \alpha a_0 - n^* a_1$$

from which

¹¹ It will be readily seen that the formulation conforms to our earlier assumptions: If $\alpha = 1$, the supervisee acquires the supervisor's level of technical skill; if $\alpha = 0$, the supervisee's performance is unaffected by that of the supervisor. It is also clear that $\partial a_{ij} / \partial a_i > 0$, and $a_{ij} > a_{ik}$ for all $k > j$

$$R_{011} - R_{01} = n^*[(n^* \alpha^2 - \alpha) (a_0 - a_1) - a_1]$$

It pays to expand an enterprise from two to three levels if

$$R_{011} - R_{01} \geq 0, \text{ that is if:}$$

$$(n^* \alpha^2 - \alpha) (a_0 - a_1) \geq a_1$$

The proof can readily be extended to any $m > 2$.

6. If the labor force is heterogeneous, the less qualified individuals should be engaged as workers, and the more qualified ones as bureaucrats.

Let there be two types of Agent, A_1 and A_2 , where $a_1 > a_2$, and let (4) be the pass-through function. Compare the rental yielded by a three-tier organization which employs n^* A_1 -type bureaucrats and n^{*2} A_2 -type workers with one which employs n^* A_2 -type bureaucrats and n^{*2} A_2 -type workers. From (5) it follows that:

$$R_{012} = n^{*2} \{ \alpha^2 a_0^2 + \alpha(1 - \alpha) a_1 + (1 - \alpha) a_2 \} - (n^* w_1 + n^{*2} w_2)$$

$$R_{022} = n^{*2} \{ \alpha^2 a_0^2 + \alpha(1 - \alpha) a_2 + (1 - \alpha) a_2 \} - (n^* w_2 + n^{*2} w_2)$$

From which:

$$R_{012} - R_{022} = n^{*2} \alpha(1 - \alpha) (a_1 - a_2) - n(w_1 - w_2)$$

If $w_1 = a_1$ and $w_2 = a_2$, then $R_{012} > R_{022}$ provided that $\alpha(1 - \alpha) > n^*$, but since $n \geq 2$ and $\alpha \leq 1$ this condition is always satisfied. It is therefore profitable to place more skilled individuals on higher rungs of the hierarchy.

From the above it follows immediately that:

7. It is never profitable to place a more qualified individual under the supervision of one who is less skilled

If an A_2 -type worker were replaced by an A_1 -type worker output would grow by $(a_{021} - a_{022})$. Applying (4) we see that output growth would amount to $(a_1 - a_2)(1 - \alpha)$.

At the same time the wage bill would grow by $(w_1 - w_2)$. If $w_i = a_i$, ($i=1,2$), then the wage bill growth would amount to $(a_1 - a_2)$. Since $\alpha > 0$, the growth in output is less than the growth in the wage bill, which means that it will never be profitable to place an A_1 -type worker under an A_2 -type supervisor.

Under some circumstances (a war emergency, for example), maximum output, rather than maximum profit is the goal. It can be shown that if the span of control is small, and the transfer coefficient is low, output can be raised more by making a “high tech” individual into a worker instead of making him a bureaucrat. In such a situation, however, the replacement of a low-tech by a high tech individual raises production cost.

Consider, again, an enterprise which employs only A_2 -types. One A_1 -type becomes available for employment.. If he replaced an A_2 -type bureaucrat, output of the organization would increase by:

$$\Delta Q(I) = \{n[\alpha^2 a_0 + \alpha(1-\alpha) a_1 + (1 + \alpha)a_2]\} - \{n[\alpha^2 a_0 + \alpha(1-\alpha) a_2 + (1 + \alpha)a_2]\}$$

where the expression in the first $\{\}$ bracket shows the output of a team consisting of an A_1 -type bureaucrat working under an A_0 -type principal, and supervising n^* A_2 -type workmen, while the second bracket shows the output of a team consisting of an A_2 -type bureaucrat working under an A_0 -type principal, and supervising n^* A_2 -type workmen.

On the other hand, if the A_1 -type replaced one A_2 -type worker, output would grow by:

$$\Delta Q(II) = (\alpha^2 a_0 + \alpha(1-\alpha) a_2 + (1 + \alpha)a_1) - \{ \alpha^2 a_0 + \alpha(1-\alpha) a_1 + (1 + \alpha)a_1 \}$$

By substitution and rearrangement of terms, it can be shown that Strategy I raises output by more than Strategy II, as long as

$$n\alpha \geq 1$$

As long as $\alpha > 1/2$, the output of the smallest viable team, consisting of a supervisor and two supervisees can be raised more by putting the A_1 type in the supervisory position rather than making him into a supervisee. The larger the team, the smaller the critical size of n . Thus even if the size of the output is the critical organization the rule of placing the higher qualified individuals in the higher position generally holds.

Let us now define the economically optimal level of bureaucracy. We shall focus our attention on the public sector bureaucracy, particularly vulnerable to criticism – and assume, as is done in Findlay and Wilson (1987) that all the final goods and services are produced under competitive conditions by the private sector while the public sector produces an intermediate good, such as “law and order”. The production function can be written as:

$$Y = A(L_G)F(K, L_P) \tag{6}$$

In the private sector L_P labor is applied to K , a fixed volume of capital. The public sector utilizes labor only to produce the factor-augmenting intermediate product A .

All labor is drawn from a common pool,

$$L_G + L_P = L \tag{7}$$

The wage is equal to the marginal product of labor in the private sector:

$$w = A L_P \tag{8}$$

We shall assume that Agents in the private, perfectly competitive system strive to maximize their income. The decision-maker in the public sector strives to maximize the Gross National Product. Maximization of Y with respect to L_G (taking into

account (7) yields the first order condition:

$$A' F(K, L_G) = A L_P \quad (9)$$

Where the LHS represents the marginal product of labor in the public, and the RHS the marginal product of labor in the private sector. At the optimum level of government employment, L_G^* , the marginal product of labor in both sectors is equal, and national income is maximized. Efficient allocation of public sector labor implies that the number of government bureaucrats is an increasing function of government employment. It follows that given L_G^* we can determine the economically optimal number of government bureaucrats L_{GB}^*

To sum up. A Weberian bureaucracy utilizes “knowledge” in an efficient manner. Where the public sector decision-makers is to maximize GNP, both the number of public sector bureaucrats and the output of intermediate public goods in at an optimum.

4 Bureaucracy and the Principal-Agent Problem

In his discussion of bureaucracy Weber assumed that the Principal of a hierarchic organization and all his Agents were driven by the same motives. This assumption might be true if the organization is a fire fighters’ brigade, or an army driven by patriotic motives. In his well-known critique of the public sector bureaucracy Von Mises asserted that there was also unity of purpose among employees of profit-oriented entities imbedded in a competitive system . Competition, Von Mises claims, solves costlessly the Principal-Agent problem.

“[T]he working of the capitalist system forces the entrepreneur to obey the orders issued by the consumers... He does not have the power to distribute bounties at the expense of

the consumers... The same relation that exists between the general manager and his immediate subordinates, the heads of the various sections, pervades the whole business hierarchy. Every section head values his immediate subordinates according to the same principle by which the chief manager values him, and the foreman applies similar methods in appraising his subordinates... It does not matter whether piece rates or hourly wages are paid. In the long run the worker can never get more than the consumer allows"(Von Moses, 1944, p.37)

To paraphrase Von Mises: Consider a perfectly competitive economy. In the long run equilibrium a firm imbedded in such an economy makes a zero profit. To make zero profits, all jobs must be allocated so as to maximize efficiency (as discussed above). In appointing the general manager the ultimate claimant must, therefore, be guided solely by considerations of profitability, and the same holds true of the appointments of all subordinates made by their superiors. If any Agent fails to work with full efficiency, the firm makes a loss, and the Agent loses his job, hence no agent will shirk on the job. Though Agents work as a team, there is no free-rider problem, because every Agent's performance is critical.¹²

The Von Mises argument does not hold, however, in the presence of uncertainty. Even if the expected value of profits for any firm is zero, short-run profits may be positive or negative. Let π be the profit which an enterprise expects to realize in the short run, under the assumption that no employee shirks, and let ρ_i be the i th employee's contribution to the profit. Under the (extreme) assumption that a one-period loss would lead to liquidation, the i th employee would have an incentive to work only if his effort was critical, that is if $\pi \geq 0$ while $(\pi - \rho_i) < 0$. If $\pi < 0$ the enterprise would go bankrupt whether he worked or not, hence he would be better off if he relaxed and enjoyed on-the-

¹² One could, of course, raise the objection that if all Agents are paid at their opportunity cost, they suffer no loss from the collapse of the firm that employs them, hence no one who is paid per unit time has any incentive to work.

job leisure. If $(\pi - \rho_i) \geq 0$, the enterprise would show a profit whether he worked or not. It is clear ρ_i increases with the i th Agent's hierarchic rank. Under our assumptions if the "boss" shirks, the enterprise makes a loss, hence the (assuming that the magnitude of the loss is a matter of indifference) the "boss's" effort is critical except when bankruptcy is inevitable. But in the absence of a reward-and-punishment system, a production worker in a large enterprise has little if any incentive to work.

Let us define an efficient incentive scheme instituted by a competitive profit-oriented enterprise¹³. The principal, acting as a Stackelberg leader, monitors the employee's performance; he pays w to an employee whose performance is satisfactory, and metes out punishment k if performance is below standard¹⁴. Employees seek to maximize their utility, derived from their earnings w and from on-the-work leisure, hence $u(w,e)$ with $\partial u/\partial w > 0$ and $\partial u/\partial e < 0$. We assume that π , the probability an Agent's work being found to be unsatisfactory, increases in the intensity of monitoring m , and that it decreases with the employee's effort, i.e. $\pi(e,m)$ (where $0 \leq e \leq 1$ and $0 \leq m \leq 1$) with $\pi'_m < 0$ for $e < 1$ and $\pi'_e > 0$ for $m > 0$, $\pi(e,0) = 1$ and $\pi(1,m) = 1$.

The wage-punishment "package" offered by the enterprise must yield at least as much utility $u(v)$ as the prospective employee's opportunity cost. Assume, as earlier, that the alternative is self-employment, yielding utility $u(s)$ with probability 1. We shall express a prospective employee's participation constraint in the form of a the Von Neumann-Morgenstern function:

¹³ A formal proof of the propositions that follow will be found in Calvo and Wellisz,(1978) and (1979).

¹⁴ For the sake of simplicity do not discuss a finer grading of the employee's performance.

$$u(v) = \pi(m, e)u(w, e) + (1 - \pi(m, e))u(k) \geq u(s) \quad (10)$$

The problem of the Principal in a profit-oriented enterprise is to choose w , k , and the intensity of monitoring m so as to induce a profit-maximizing effort on the part of the employees:

$$\text{Max}_{w, k, m} \Pi = e(w, k, m) - c(w, m) \quad (11)$$

(where $e'(w) > 0$, $e'/k > 0$, $e'(m) > 0$, $c'(w) > 0$ and $c'(m) > 0$)

The severity of punishment is limited by custom, by law, or by agreement. Writing k for actual punishment and \underline{k} for the most severe punishment that is permitted, we have:

$$|k| \leq |\underline{k}| \quad (12)$$

From the Principal's point of view punishment is costless, hence he will set it at the maximum permissible level.

The Principal will seek to maximize (11) subject to (10) and to (12) and offer a least cost (i.e. profit maximizing) "package" $v^*(w^*, m^*, \underline{k})$ acceptable to the employees, where:

$$v^* = [\pi(m, e(w^*, m^*, \underline{k}))]u(w^*) + [1 - \pi(m^*, e(w^*, m^*, \underline{k}))]u(\underline{k})$$

In the absence of a limit on the severity of punishment, the entrepreneur could solve the Principal-Agent problem without incurring hardly any cost. He could offer to the A_i - types a wage $w_i = a_i$, and elicit full effort by keeping monitoring to a minimum necessary to create a credible threat of punishment. But since $\partial u / \partial e < 0$ and $e'(k) > 0$, it follows that $\partial e / \partial k < 0$, i.e that other things being equal, the less severe the punishment, the lower the effort, hence the higher the cost of a unit output of labor. If the worse that

can happen to an employee is to be discharged, he will perform no work, unless he is offered a wage higher than his self-employment opportunity cost. At equilibrium $\partial e/\partial m = \partial e/\partial w$, which means that the higher the marginal cost of monitoring, the higher the wage needed to elicit effort, and the higher the cost of the product of labor. Thus even in the case of pure competition there is a wedge between the enterprise labor cost and the opportunity cost of the wage-earners.

5. Problem of the public sector bureaucracy.

The incentive problems faced by public sector, non-profit oriented Bureaus are greatly more severe than those facing competitive profit-oriented enterprise.

“The objectives of public administration cannot be measured in money terms and cannot be checked by accountancy methods... In public administration there is no market price for achievements. This makes it indispensable to operate public office according to principles entirely different from those applied under the profit motive” (Von Mises, 1944 p. 47)

In the absence of a simple, measurable objective, such as profit maximization, in choosing his subordinates the head of a Bureau may be motivated by considerations other than those of efficiency:

“The seller-buyer nexus as well as the employer-employee relation, in a profit-seeking business is purely matter of fact and impersonal. It is a deal from which both parties derive an advantage.... But it is different with a bureaucratic organization. There the nexus between superior and subordinate is personal. The subordinate depends on the superior’s judgment of his personality, not of his work” (ibid. p. 53)

The professionalization of the civil service is a guard against biased treatment. Posts are filled on the basis of objective criteria, such as the educational attainment and the length of service. “Objective measures are characterized by the fact that they can be

verified for contractual purposes “. The subjective criteria, which are barred , include “anything that is not verifiable by a third party” (Prendegast, 1999 p.12) The elimination of the subjective criteria narrows the set of signals used for evaluation and for the determination of rewards and punishment , and reduces efficiency of the system (see Holmstrom, 1979). The exclusive reliance on objective criteria may have perverse effects, for:

”this machinery for selection sometimes bars the competent men from a job and does not always prevent the appointment of an utter incompetent. But the worst effect produced is that the main concern of the clerks is to comply with these and other formalities. They forget that their job is to perform an assigned duty as well as possible” (Von Mises, op. cit. p.55)

The civil servants’ duties are often subdivided into well defined, readily measurable tasks, such as the filing of reports, the issuance of certificates, and other activities commonly referred to as “red tape”. Here, too, there is gain in objectivity, at the expense of efficiency. The effect of the exclusive reliance on objective criteria means that the public sector bureaucrats are less closely monitored than their profit-oriented sector counterparts. A Civil Servant’s career is determined by his formal qualifications and his fulfillment of his duties. Effort, over and above a set minimum, is not rewarded.

It can be readily shown that the wedge the cost of labor and the opportunity cost of the Agents is wider in the case of public sector bureaus than in the case of profit-oriented enterprises. To compete for labor with the private sector, the public sector wage-monitoring-punishment offer $(w_{cs}, m_{cs}, \underline{k}_{cs})$ must be as attractive as the conditions offered by private business. But business offers the least-cost “package” $(w^*, m^*, \underline{k})$, hence any other “package”, such as $(w_{cs}, m_{cs}, \underline{k}_{cs})$ must be more expensive. The “Civil

Service” package involves less pay and lower penalties than the business ”package”, hence it elicits less effort.¹⁵ The Civil Service employees tend to work less hard and enjoy more on the job leisure than private business bureaucrats, because the latter are better rewarded for good performance, and face more severe ¹⁶. As a consequence, more employees are needed to perform a given task. Bureaus do not do too much; the bureaucrats do too little. But, given the Civil Service constraints, the size of the bureaucracy cannot be squeezed down without reducing the supply of public goods.

6. The Niskanen hypothesis

In his 1971 book Niskanen advanced arguments that it is in the interest of the public sector bureaucrats as well as in the interest of the politicians who oversee their activities to over-expand the public sector bureaus. The heads of bureaus seek to maximize the number of employees, because the higher their rank, their prestige and their salary are the higher the larger their bureau. The subordinates also have a vested interest in the growth of the bureau size, since the larger the bureau, the more possibilities of hierarchic advancement.¹⁷ In the US, the relationship between the government bureaus and the political establishment is one of bilateral monopoly. A given public service is, typically, provided by only one bureau, and every bureau comes under the supervision of a Secretary (or one of his subordinates) and/or of a House committee. Committees for each

¹⁵ The incentive effect of wages is also blunted insofar as advancement depends upon the length rather than the quality of service.

¹⁶ If the population is heterogeneous in terms of attitudes toward work, self-selection may take place. Individuals with high preference for security and/or on the job leisure might opt for civil service jobs; those with a low degree of risk aversion and/or low preference for on the job leisure would opt for the profit-oriented sector.

¹⁷ The idea of a bureau-maximizing bureaucracy was originally advanced by Parkinson (1957), but it gained the profession’s attention only after Niskanen’s formalization .

service are likely to be dominated by the groups with the *highest* relative demand for the service (Niskanen, 1971, p. 139). Groups that have a high demand for a given service are also likely to exercise pressure on the government. Groups that oppose high level supply are likely to remain silent, unless they have to pay a tax designated to finance the service in question, hence the weakness of the forces favoring budgetary restraint. As a consequence Bureaus grow to the point at which the Social Surplus created by their activities is exhausted by Bureau costs, or up to the point at which the marginal product is zero – whichever comes earlier.

Niskanen's analysis stimulated the construction of models of interaction between public-support-seeking politicians, bureau-size-maximizing bureaucrats and utility-maximizing voters.¹⁸ His behavioral hypotheses provoked controversy and incited attempts at empirical verification. Not surprisingly, it was easy to demonstrate that “the great majority of bureaucrats want and ask for more money” to perform pre-determined tasks. (Blais and Dijon, 1991, p. 356). There is little evidence, however, of pressure to increase the size of bureau personnel. Inter-bureau personnel mobility is high, hence the head of a relatively small bureau can more readily improve his position by moving on to head one that is larger or more prestigious than by expanding his own bureau. Subordinate bureaucrats have little to gain from the expansion of the size of their organization, because their advancement depends primarily on their initial qualifications and on the length of service (Margolis, 1975). Likewise, there is little evidence that bureaucrats seek to expand the scope of bureau activities (Sigleman, 1986). On the

¹⁸ See in particular, Fiorina and Noll (1978), Romer and Rosenthal (1978), Mackay and Weaver (1981), and Miller and Moe (1983)
For a comprehensive survey see Gill (1995)

contrary, “Senior executives are less likely than the general public to favor increases in spending on the vast majority of government programs, contrary to the assumptions about self-interested bureaucratic behavior” (Dolan, 2002).

Niskanen was also criticized for basing his arguments on idiosyncratic US institutions, such as “the existence of relatively autonomous agencies having direct relationships with their legislative sponsors, and to some extent on that sponsor being structured in an equally decentralized manner”(Peters, 1991 p. 305)¹⁹. Yet bureaucratic over-expansion is said to occur in countries with institutions quite alien to those of the United States, including benevolent and malevolent dictatorships. And even if one focuses only on the United States it is far from clear what is the nature of the political process that limits expansion to the point at which the marginal product of a bureau is zero, or at which the bureau exhausted consumers surplus (whichever comes earlier).

Last but not least, few people in the United States (or elsewhere) complain that there is too much Law and Order, that in the public schools the teacher/student ratio is too high, or that the Postal System deliveries are too frequent. The common complaint is not that government bureaus do too much, but that there are too many bureaucrats and that they sluggishly perform their jobs.

Experience, reflection, and the contributions of other scholars, led Niskanen to modify his hypothesis of the causes and consequences of over-expansion of bureaucracy.

According to the later version,

¹⁹ Niskanen may also be faulted for failing to explain how the political mechanism determines the boundary conditions of bureau expansion.

“[B]ureaucrats act to maximize their bureau’s discretionary budget defined as the difference between the total budget and the minimum cost of producing the output expected by the political authorities...[T]he surplus is spent in ways that serve the interests of the bureaucrats and the political authorities” (Niskanen, 1991, pp.18-19)²⁰

Niskanen now outlines the mechanics of over-expansion in seven points::

1. The bureaucrats’ behavior differs from that of other Economic Agents because bureaucrats face “incentives and constraints that are specific to bureaus”
- 2.” Most bureaus face a monopoly buyer of their service, usually some group of political officials. The effective demand for the output of a bureau is that of his political sponsor, rather than that of the ultimate consumer of this service.”
3. “Most bureaus are monopoly suppliers of their service.”
4. “The bilateral monopoly relation between a bureau and its sponsor involves the exchange of a promised output for a budget, rather than the sale of its output at a per-unit price. As in any bilateral monopoly, there is no unique budget-output equilibrium between that preferred by the sponsor and that preferred by the bureau. The sponsor’s primary advantages in this bargaining are its authority to replace the bureau’s management team... The bureau’s primary advantage is that it has much better information about the costs of supplying the service than does the sponsor.”
6. The sponsor uses “its authority primarily to capture part of the bureau’s surplus in ways that serve the specific interests of the sponsor group, rather than the interests . of the broader group of legislators and voters”
7. “[N]either the members of the sponsor group nor the bureaucrats have a pecuniary share in any surplus generated by the bureau. The effect of this condition is that the surplus will be spent in ways that indirectly serve the interests of the sponsor and the bureau, but not as direct compensation. (Ibid. pp. 16-17)

The revised version is more readily acceptable, yet it fails to yield the sharp conclusions of the original formulation. These can be re-captured through a simple model based on the assumptions that (1) governments, regardless of the type of regime seek

²⁰ Niskanen states that he adopted the concept of a discretionary budget maximizing hierarchy from Migué(1974)

support to maintain themselves in power, and (2) that patronage is one of the means of gaining support.

The professionalization of the civil service notwithstanding, in every regime some administrative positions are filled through a political process. to reward influential individuals. The qualifications of the appointees are of secondary importance: the goal of the appointments are to gain (or to maintain) support. The loss of efficiency is the economic cost of the political support.

To explore the implications of the spoils system, let us assume, for the sake of simplicity, that all the government posts are filled by a Ruler, who may be an elected official, a hereditary monarch, or a modern dictator. The public sector job-holders support the Ruler. But the public sector is financed at the expense of the private sector, hence the Ruler, seeking to maximize support S has to take into account the impact of public sector job creation on national income. Assuming that private sector labor L_P and public sector labor L_G are drawn from the same pool L , we can express the Ruler's objective function as:

$$\text{Max}_{L_G} S = S(L_G, Y(L_P, L_G)) \quad L_G + L_P = L \quad (13)$$

subject to:

$$L_G + L_P = L$$

At political optimum

$$\partial S / \partial L_G = - (\partial S / \partial Y) (dY / dL_G) \quad (14)$$

Since $\partial S / \partial L_G > 0$ and $\partial S / \partial Y > 0$, it follows that $dY / dL_G < 0$. But at economic optimum

$dY/dL_G = 0$ and $d^2Y/dL_G^2 < 0$. It follows, therefore, that the politically optimal level of public sector employment exceed the level that is economically optimal. This result conforms to Niskanen's original hypothesis, but it does not depend on the bureaucrats' bureau size maximizing behavior.

Let us now take into account the fact, that in the case of political appointments the qualifications of the appointees are of secondary importance, and let $\lambda \leq 1$ to be the coefficient expressing the difference between the effectiveness of professional civil servants and that of political appointees. Making use, once again, of the Findlay-Wilson model (see (6) to (8) above) we can write the Ruler's objective function as:

$$\text{Max}_{L_G} U = b L_G + (1-b)A(\lambda L_G)F(K, L_P) \quad (15)$$

$$\text{Subject to } L_G + L_P = L$$

where b ($0 \leq b \leq 1$) is the weight attached by politicians to the support of public sector job-holders, and $(1-b)$ to the level of national income. It should be noted that this formulation is consistent with the hypothesis that the ruler not only needs support (which he gains by making political appointments) but that he also cares about the well-being of the polity as a whole (to which he attaches a weight of $(1-b)$)²¹

Treating λ as a constant²² we see that, at political optimum,

$$A'F - A\partial F/\partial L_P = b/(1-b)\lambda \quad (16)$$

The greater the political benefit derived from the dispensation of patronage (the higher

²¹ For a recent discussion of the political objective function, see Milo (2001)

²² Since we assume that public sector employment has diminishing returns., we cannot obtain any additional insights by recognizing the fact that the efficiency of the public sector is likely to be the lower, the larger the number of political appointments, or, in our terms that $\lambda(L_G)$ and $\lambda' > 0$.

the b), and the lesser the weight attached to the competence of the political appointees, the greater the difference between the marginal product of labor in the private and the public sector. Since the marginal product in both sectors declines, it follows that the higher the b , the greater the degree of over-expansion of the bureaucracy. The appointment of politically important incompetents reduces the effectiveness of public sector production and national income²³

7. The problem of loyalty, and trust.

Bureaucrats, Breton and Wintrobe claim, are neither inherently efficient, nor inherently inefficient. They behave selectively, where “Selective behavior... is the capacity of subordinates to be sometimes efficient and sometimes inefficient in pursuing the goals or objectives of their superiors”. (Breton and Wintrobe, p.37). Efficient behavior is defined by Breton and Wintrobe in terms of fulfillment of tasks assigned to a bureaucrat by his immediate superior; inefficient behavior - in terms of the bureaucrat pursuing his own goals. To avoid confusion, we shall use the terms loyal and disloyal behavior to designate, respectively, an Agent’s effort devoted to performance of tasks assigned by the organization, and the effort devoted to the pursuit of own goals.²⁴

Let us draw a distinction between states of nature which, from the point of the organization are “good” and those which are “bad”. The “Good” state is expected to occur with probability π_G , and the bad state with probability $\pi_B = (1 - \pi_G)$. All Agents behave loyally in the “Good” state. In a “Bad” state, a proportion of Agents χ behaves

23 Alternately, we may look at the Niskanen process as a “game” between politicians seeking to expand patronage, and a parliament seeking to limit tax collected to finance public sector employment.

24 In what follows we shall abstract from differences in socio-psychological make-up which determine an Agent’s tendency to act loyally or disloyally under the same circumstances, and focus on the opportunity cost of the alternate modes of behavior

loyally, while $(1 - \chi)$ is disloyal. An Agent is the more likely to act disloyally, the higher the expected payoff from such behavior, relative to the payoff from loyal behavior, the lower the probability of being punished for disloyalty, and the lower the penalty for disloyalty. When an Agent acts disloyally, he puts forth zero effort in the work for the organization which employs him. The head of the organization engages Agents before the “State of Nature” is known. He is able to mete out punishment e.g. by discharging an employee if and when his disloyal behavior is detected, but, while the “Bad” state lasts, he cannot replace disloyal employees by other hires. As a consequence, if an employee acts disloyally, his output, and that of his subordinates, is lost to the enterprise. We shall assume that the heads of the organizations are risk-neutral; the conclusions hold *a fortiori* if they are risk-averse.

Consider first the case in which the head of the organization cannot determine ex ante whether an Agent will be loyal or disloyal. This means that any Agent he hires will behave loyally with probability $\chi\pi_B$, i.e. that the effective labor force will be $\chi\pi_B n$ where n is the total number of employees. Assuming, to simplify the exposition, that there exists a metric for the measurement of output, an A_i -type head of an organization will form a 2-layer structure and hire n^* A_j -type workers if:

$$R_{ij} = n^*(\chi\pi_B a_{ij} - a_j) \geq a_i \quad (17)$$

From which it can be seen that the higher the probability of disloyal behavior, the lower the organization’s rent.

In the case of a three-layer organization one of the n^* bureaucrats will perform disloyally with probability $(1-\chi)(1-\pi_B)$ idling the n worker team under his supervision. Of the remaining $(n^{*2}-n)$ production workers a proportion $(1-\chi)(1-\pi_B)$ is also expected to remain idle. Thus the effective labor force would be $(\chi\pi_B n^*)^2$. The rent from a 3-tier organization is:

$$R_{ijk} = (\chi\pi_B n^*)^2 a_{ijk} - (n^*a_j + n^*a_k) \quad (18)$$

Subtracting (17) from (18) we obtain the profitability condition:

$$(R_{ijk} - R_{ij}) = (\chi\pi_B n^*)^2 a_{ijk} - (n^*a_j + n^*a_k) - n^*(\chi\pi_B a_{ij} - a_j) \geq 0$$

Assuming, as was done above (see (5)) that the pass-through process can be represented by

$$a_{ij} = \alpha a_i + (1-\alpha) a_j$$

we obtain:

$$(R_{ijk} - R_{ij}) = (\chi\pi_B n^* \alpha)(\chi\pi_B n^* \alpha - 1) [a_0 + a_1(1-\alpha)/\alpha] - n a_1(n-1)$$

which shows that the advantage of a three-level over a two-level organization is the greater, the higher the probability that the employees will behave loyally. The possibility of disloyal behavior thus reduces the advantage of a hierarchic organization, and it “flattens” the structure.

The ability to categorize potential employees into those who are loyal, and those who are disloyal is clearly to the employer’s advantage: “Trust can dramatically reduce both transaction costs – replacing contracts with handshakes- and agency risks- replacing the fear of shirking and misrepresentation with mutual confidence” (Adler, 2001, p. 219) Insofar as higher hierarchic posts command higher salary or bring greater psychic utility,

it is also to the advantage of potential employees to be considered to be loyal, i.e. to gain the trust of the prospective employer Breton and Wintrobe suggest that trust can be earned:

“Assume... that all transactions take the form of \$1 loans. Then if A has the belief that B is confident in the same degree that B will honor or repay \$1 (plus interest) at some specified time in the future, we say that A has an amount t_{AB} of trust in B” (Breton and Wintrobe, *op. cit.* p. 65).

Trustworthiness is a question of the sum involved as well as of the degree of confidence that the implicit contract will be honored. The larger the number of \$1 loans B has repaid, the greater A's confidence that he will repay such future loans. But such a record would not necessarily mean that A would be equally confident if B asked him for a \$1,000 loan.

Trust can also be won through voluntary acceptance of a contract specifying severe punishment for disloyalty. Let the contract offered to potential employees specify such a punishment κ . An individual who would not act disloyally in a “Bad” state of nature would accept the contract, provided the wage offered exceeds his self-employment opportunity cost. Since he will not act disloyally, he does not take into account the disutility of punishment. Not so the disloyal individual who, in deciding whether to participate or not, takes into account the utility of disloyal behavior in case of a “Bad” state of nature. A sufficiently severe punishment would force him to act loyally, thus reducing his utility, and making the offer unattractive.

To the above one may object that \underline{k} the maximum socially permissible punishment may not be sufficiently severe to deter disloyalty. However, in a heterogeneous society, the disutility of punishment may differ among social groups. The mutual trust of members of closely-knit communities, such as medieval Jewish or Arab merchants, or of certain contemporary overseas Indian and Chinese communities, may be explained in terms of the threat of exclusion in case of disloyalty. Even in open societies, on which exclusion is no threat, it may be possible to devise institutions the membership in which bestows privileges, but which inflict severe punishment on disloyal members. For instance, the Communist Party in the Soviet Union bestowed privileges on its members, but individuals who were excluded from the Party found themselves in a much worse position than those who never were members.

Let us now examine a situation in which the Principal can identify in advance whether the potential employees are loyal (A_L) or disloyal (A_D). He also knows that A_L -type individuals have ability a_L , and A_D -type individuals ability a_D , where $a_L < a_D$ ²⁵. Take a 3-level organization whose head is an A_0 -type and which is staffed entirely with A_L -individuals. The output such an organization can be written as:

$$Q(L) = n^2 a_{0LL}$$

where n^2 is the number of production workers and a_{0LL} is the output of an A_L -type worker supervised by an A_L -type bureaucrat working for an A_0 -type principal.

Assuming, as earlier that the pass-through of technological knowledge from an A_i -type supervisor to an A_j -type supervisee can be expressed as (5) above, the output of such an enterprise can be expressed as:

²⁵ The case in which $a_L \geq a_D$ is trivial

$$Q(L) = n^2 \{ \alpha^2 a_0 + \alpha(1 - \alpha) a_L + (1 - \alpha) a_L \}$$

Could output be raised by replacing one employee by an A_D – type, and, if so, at what level should he be placed? If, in a three-layer organization, one A_L – supervisor were replaced by an A_D –type supervisor, output would rise by $n(a_{012} - a_{022})$ with probability π_B , and it would decline by na_{022} with probability $(1 - \pi_B)$. The expected change in output is therefore equal to:

$$\Delta Q_{DS} = \pi_B n(a_{012} - a_{022}) - n(1 - \pi_B) a_{022} = \pi_B na_{012} - na_{022} .$$

Output will increase as long as: $\Delta Q_{DS} > 0$, that is, as long as:

$$\pi_{B(DS)} > a_{022} / a_{012}$$

If, instead, the A_D –type were to replace an A_L –type a_{022} worker, output would increase by $a_{021} - a_{022}$ with probability π_B , and it would decrease by a_{022} with probability $(1 - \pi_B)$.

The expected change in output is therefore equal to:

$$\Delta Q_{DW} = \pi_B (a_{021} - a_{022}) - (1 - \pi_B) a_{022} = \pi_B na_{021} - na_{022} .$$

Output will increase as long as: $\Delta Q_{WS} > 0$, that is, as long as:

$$\pi_{B(DW)} > a_{022} / a_{021}$$

To appraise the relative magnitudes of $\pi_{B(DS)}$ and of $\pi_{B(DW)}$ it is necessary, once again, to specify the pass-through function. Assuming, as before, that the pass-through function can be expressed as in (5) we obtain:

$$(a_{012} - a_{021}) = (1 + \alpha^2) (a_2 - a_1) .$$

But since $a_2 < a_1$ this expression is always negative, which means that $a_{012} < a_{021}$, hence the critical value of $\pi_{B(DW)}$ is higher than that of $\pi_{B(DS)}$. If there is a high probability of

occurrence of a “Bad” State of nature, it is preferable to place able, but disloyal, individuals in lower than in higher hierarchic positions.

Whether it is worth giving a disloyal individual any hierarchic post depends on his relative efficiency. The higher the productivity of an A_D -type relative to that of an A_L -type, the more risk of disloyalty is worth bearing. This may explain the fact that even in the Soviet Union some exceptionally able individuals whose loyalty to the regime may have been open to doubt occupied positions of prestige and power.

8. Summary and conclusions

In this paper we built a simple model to demonstrate that bureaucratic-hierarchic organizations are efficient *provided* that they can costlessly solve the Principal-Agent problem. Under the pressure of competition profit-oriented enterprises adopt least-cost reward-cum-punishment “packages” that satisfy the participation constraints of Agents who have the choice of self-employment. In the case of Government Bureaus and of other non-profit entities, the absence of a simple metric of success makes it difficult to appraise performance, and increases the probability of favoritism. The professionalization of the civil service reduces the likelihood of bias – but at the cost of efficiency.

Max Weber, and most of his followers and critics, assumed that bureaucratic structures were built to achieve goals set by outside authorities, such as enterprise owners or government officials. Niskanen advanced the startling idea that the objective of politicians as well as bureaucrats was to maximize the size of the bureaus. At a later

stage Niskanen retreated from his earlier assertions. We utilize a simple politico-economic model which recaptures Niskanen's original results while meeting the objections of his critics. Finally we show that in hierarchic organizations loyalty of the Agents plays a major role. This explains why in such structures as the Soviet "Nomenklatura" highly qualified but untrustworthy individuals were, typically, confined to lower rungs of hierarchy knowledge in society.

References

Adler, Paul S. (2001) "Market, Hierarchy, and Trust: The Knowledge Economy and the Future of Capitalism" *Organization Science* vol. 12 no. 2 (March-April) pp. 215-234

Bendix, Reinhard D. (1956) *Work and Authority in Industry* University of California Press: Berkeley, California

Bendix, Reinhard D. (1968) "Bureaucracy" *International Encyclopedia of the Social Sciences* vol. 2 New York: Macmillan and the Free Press

Blais, André and Stéphane Dion "Conclusion: Are Bureaucrats Budget Maximizers?" in Blais, André and Stéphane Dion (eds.) 1991 *The Budget Maximizing Bureaucrat: Appraisals and Evidence* Pittsburgh, Pa.: University of Pittsburgh Press

Breton, Albert and Ronald Wintrobe (1982) *The Logic of Bureaucratic Conduct* Cambridge: Cambridge University Press.

Calvo, Guillermo A. (1977) "Supervision, and Utility and Wage Differentials across Firms" *Discussion Paper no. 76-7711, Columbia University Economics Workshop* April, 1977 (revised July 1977)

Calvo, Guillermo and Stanislaw Wellisz (1978) "Supervision, Loss of Control, and the Optimal Size of the Firm" *Journal of Political Economy* vol. 86 no. 5 (October) pp. 943-952

Calvo, Guillermo and Stanislaw Wellisz (1979) "Hierarchy, Ability and Income Distribution" *Journal of Political Economy* vol. 87 no. 5 Part I (October) pp. 991-1010

- Fiorina, Morris P. and Roger G. Noll (1978) "Voters, Legislators and Bureaucracy: Institutional Design in the Public Sector" *American Economic Review* vol. 68 no. 2 (May) 256-260.
- Findlay, Ronald, and Wilson, John D.(1987) "The Political Economy of Leviathan" in Razin A. and E. Sadka , (eds) *Economic Policy in Theory and Practice* London: Macmillan
- Garicano, Louis (2000) "Hierarchies and the Organization of Knowledge in Production" *Journal of Political Economy* vol. 108 no 5 (October) 879-903
- Gifford, Sharon (1992) "Allocation of Entrepreneurial Attention" *Journal of Economic Behavior and Organization* vol. 19 no 3 (December) pp. 265-285
- Holmstrom, Bengt (1979) "Moral Hazard and Observability" *Bell Journal of Economics* vol. 10, pp. 74-91
- Holmstrom, Bengt and Tirole, Jean (1988) "The Theory of the Firm" in Schmalensee, R. and Willig, R (eds) *Handbook of Industrial Organization* Amsterdam: North Holland
- Keren, Michael and Levhari, David (1979) "The Optimum Span of Control in a Pure Hierarchy" *Management Science* vol. 25 no. 11 (November) pp. 1162-1172
- Margolis, J.,1975 "Comment" [on Niskanen's Bureaucrats and Politicians] *Journal of Law and Economics* vol. 18 no. 3 (December)
- Mayer, Thomas (1960) "The Distribution of Ability and Earnings" *Review of Economics and Statistics* vol. 42 no. 2 (May) pp. 189 –195
- Meyer, Marshall W. (1985) *Limits to Bureaucratic Growth*: Berlin and New York: Walter de Gruyter
- Milo, Jeffrey 2001) What do Candidates Maximize (and Why Should Anyone Care?) *Public Choice* vol. 109 pp. 119-139
- Mirrlees, James A.(1976) "The Optimal Structure of Incentives and Authority within an Organization" *Bell Journal of Economics* vol. 7 no. 1 (Spring) 105-131
- Niskanen William A. (1971) *Bureaucracy and Representative Government* Chicago: Aldine Press
- Niskanen, William A. *Bureaucracy and Public Economics* (1994) Brookfield, Vt.: Edward Elgar
- Parkinson, C.N. (1957) *Parkinson's Law and Other Studies in Administration* New York

Ballantine Books

Peters, B. Guy (1989) *The Politics of Bureaucracy*, 3d ed.: New York and London: Longmans

Prendergast, Canice (1999) "The Provision of Incentives in Firms" *Journal of Economic Literature* vol. 37 no. 1 (March) 7-63

Qian, Yingyi (1994) "Incentives and Loss of Control in an Optimal Hierarchy" *The Review of Economic Studies* vol. 61 issue 3 (July) pp. 527-554

Radner, Roy (1992) "Hierarchy: The Economics of Managing" *Journal of Economic Literature* vol. 30 no. 3 (September) pp. 1382 – 1415

Rajan, Raghuram G. and Zingales, Luigi (2001) "The firm as a dedicated hierarchy: A theory of the origin and growth of firms" *The Quarterly Journal of Economics* vol. 116 no.3. (Aug.) pp.805-852

Sigleman, Lee (1986) "The Bureaucrats as Budget Maximizers: An Assumption Examined" *Public Budgeting and Finance* vol. 6 no. 1 (Spring) pp 50-60

Tirole, Jean (1986) "Hierarchies and Bureaucracies" *Journal of Law, Economics and Organization* vol. 2 pp. 181-214

Von Mises, Ludwig von (1944) *Bureaucracy* New Haven, Conn.: Yale University Press

Weber, Max (1946) *From Max Weber: Essays in Sociology* Translated, edited and with an introduction by H.H. Gerth and C. Wright Mills. New York: Oxford University Press

Weber, Max (1947) *The Theory of Social and Economic Organization* translated by A.M. Henderson and Talcott Parsons, New York: Oxford University Press

Williamson, Oliver E. (1967) "Hierarchic Control and Optimum Firm Size" *Journal of Political Economy* vol. 75 no. 2 (April) 123-138