

MODELING BUREAUCRATIC INCENTIVE SYSTEMS IN  
A LOCAL PUBLIC ECONOMY

by

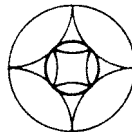
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WORKSHOP  
IN  
POLITICAL THEORY  
AND  
POLICY ANALYSIS



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Elinor Ostrom

Distinguished groups of scholars and public officials, such as the Advisory Commission on Intergovernmental Relations, have argued for many years that the structure of government in most metropolitan areas is a jungle, a maze, a jigsaw puzzle, a hurdle, -- or, other terms that convey the sense of being chaotic (ACIR, 1977). The reform repeatedly recommended for metropolitan areas is to simplify the structure. Good government is equated with simple structure. Bad government is associated with complex structure. This has been implicitly assumed. My colleagues and I at the Workshop in Political Theory and Policy Analysis have argued for some time that before we recommend massive changes in the structure of local government, we should understand how structure affects performance (V. Ostrom, Tiebout, and Warren, 1961; V. Ostrom and E. Ostrom, 1965; E. Ostrom, Parks, and Whitaker, 1978; E. Ostrom and Parks, 1982).

Without an understanding of how political structure affects outcomes, we cannot know whether recommended reforms will improve or detract from the performance of local governments. Political scientists have been slow to develop models for analyzing the effects of political structure. Many have formulated the problem as if adding dummy variables for political structure to a series of economic variables in a multiple regression equation was an appropriate way to model political structure. With such a specification, political

structure has no effect. But, should we conceptualize political structure as just one ingredient to be added to other ingredients to form an "output pie"? Is not structure something different than one variable added to many others in a general linear model? (see Parks, 1979). Does not structure affect which variables are included, their range, who controls them, and how they are weighted in complex transformations of inputs into outputs? Until we develop adequate models of the complexity we observe, how can we hope to reform it and improve performance?

As an alternative to the simple models commonly employed to analyze the effects of governmental structure on service delivery in urban areas, my colleague Roger B. Parks and I are developing a series of more complex models. These models are based on our conception of an urban system where actors occupy particular roles in a service delivery system. Their role incumbency offers them differing mixes and types of incentives and constraints on their behaviors. It is the individual actors' reactions to the incentives and constraints they face, together with their interactions with one another, that lead to the observable phenomena of urban service delivery. In order to recommend changes that may improve service delivery, one must have an understanding of the structure and workings of incentives and constraints as seen by typical actors. That understanding is the task we have laid before us in our larger project. This paper is thus a preliminary report on part of a project in progress.<sup>1</sup>

Rather than relatively simple causal models or more elaborate models of what may be termed "disorganized complexity," we see the need for models of organized complexity (Weaver, 1958). Behaviors and interactions in urban service delivery are complex. But, the

complexity is organized by the presence of institutional arrangements which act to set limits on some behaviors and interactions and to encourage others. Coming to grips with organized complexity requires the analysis of how institutions work to accomplish this structuring. Institutional analysis that examines the incentives and constraints posed by an existing combination of rule structures for given decision situations is logically prior to institutional design aimed at improving the performance of any service delivery system.

### Models of Public Service Delivery

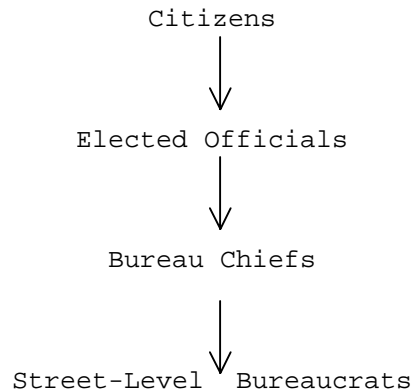
#### The Linear Model

Traditional models of urban service delivery view citizens as telling their elected officials what they want through electoral mechanisms. Public officials, in turn, command public bureaus to implement authoritative public decisions. Bureau chiefs then administer agencies so as to implement the policies determined by elected officials. Citizens ultimately receive the services delivered by street-level bureaucrats. This simple linear model of the urban public sector is represented in Figure 1.

The linear model is clearly deficient when one considers the dynamic and interactive processes which are present in most service delivery situations. Citizens do more than vote for service bundles. Public officials do not simply issue commands to bureaucratic service suppliers, and bureaucratic firms do not operate in the real world as they are assumed to in models of strict hierarchical relations. All of the links in Figure 1 are better conceptualized as interactive processes. There are in addition other interactive processes which this simple representation does not accommodate.

Figure 1

A Simple Model of the Linear Flow of Communication  
in Urban Public Sector




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The "Quadrilateral" Model

Recent empirical and theoretical studies of the representation process between citizens and public officials show this to be more complex than the straightforward transmission of citizen preferences to elected officials. Election districts can be so organized that some groups are given far more electoral strength than their relative numbers in a population deserve. Groups which can potentially gain from highly localized public programs by having the costs spread over a larger group of taxpayers are motivated to propose many special interest bills. The incentive system within most legislatures can lead to persistent over-investment in the public sector of benefit to special groups, but not in the general public interest (Shepsle and Weingast, 1981; Weingast, Shepsle, and Johnsen, 1981). Elected officials can affect citizens' demands by the setting of agendas and parliamentary maneuvering. Rather than a simple, one-way flow, then, representation is a complex interactive process.

The relationship between elected officials and public bureau chiefs, too, must be modeled as a two-way bargaining rather than a one-way command process. Given the control over information that bureau chiefs have relative to elected public officials, they may dominate the process by setting the agenda and may gain undue advantage in these bargaining processes (Niskanen, 1971; 1975). Groups, who have a high demand for the output of an agency, may aid and abet the bureau chief in negotiations with sponsoring officials (Mackay and Weaver, 1978), as many factor suppliers (Niskanen, 1971). Elected officials may attempt to reassert control by placing their supporters within the bureau (Breton and Wintrobe, 1975) and by replacing recalcitrant bureau chiefs (Parks and Ostrom, 1981). Empirical studies have now provided support for modeling this relationship as a complex bargaining process and have identified some of the potentially perverse consequences (Langbein, 1980; 1981).

Lipsky's identification of street-level bureaucrats and related anecdotal work has called clear attention to the interactive processes found in any attempt at bureaucratic management (Lipsky, 1971; Prottas, 1979; Rubinstein, 1973). On more theoretical grounds, Downs (1967), Tullock (1965), Williamson (1967; 1975), and others have drawn attention to the possibilities of control loss and information distortion in hierarchically organized agencies where lower level bureaucrats exercise substantial control over their superiors. These models point to an interactive process between bureau chiefs and street-level bureaucrats.

The street-level bureaucrat to citizen linkage is not a one-way flow of service delivery either. Fuchs (1968) and Garn, et al.

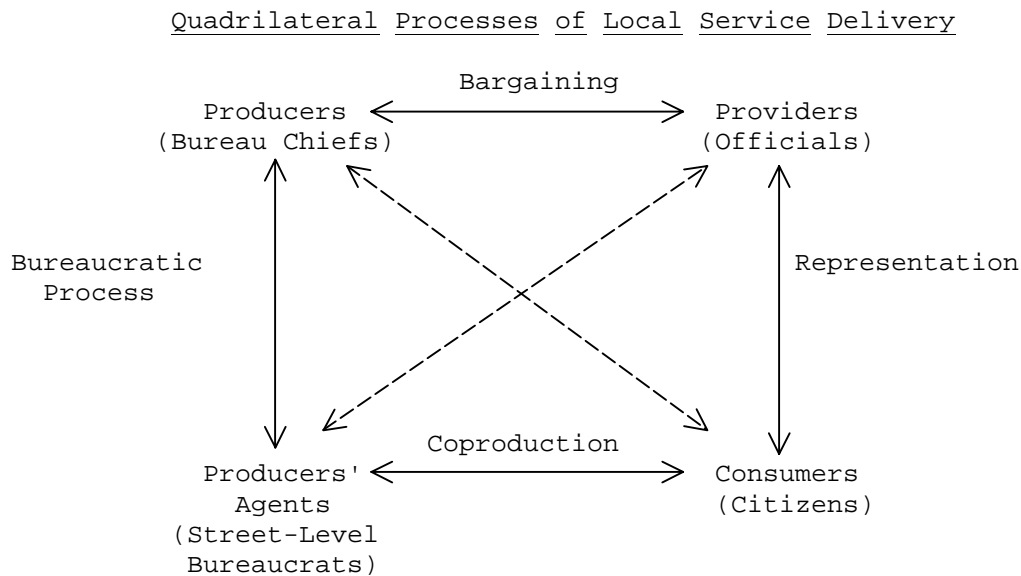
(1976), have identified the key role of consumers in the actual production of public services. This work is consistent with the thrust of Lancaster (1966) and Becker (1976) on consumer production, conceptualizing consumers as using the intermediate products of service agencies in their own production of commodities. We have identified this interactive process as coproduction (Parks, et al., 1981), attempting to treat the linked activities of street-level bureaucrats and citizens as a team production process akin to that discussed by Alchian and Demisetz (1972).

Citizens make their service preferences known in more ways than simply voting for officials offering particular slates. It is common for citizens to contact bureau heads directly with their service demands. Many public bureaus have "hot lines" to facilitate this process. Bureau chiefs have also been known to lobby citizens directly for support of their agency when involved in difficult negotiations with city officials. These cross-link processes between citizens and bureau heads are ignored in the simple model of Figure 1. So too are the perhaps more important processes linking public employees and elected officials. With the extensive unionization of street-level bureaucrats and the intervention of union leaders and members into public debates, this linkage cannot be ignored. Too, there is sole reason to believe that bureau employees turn out at substantially higher rates in local elections, thus, weighting their "voice" heavily in the electoral process of the conventional model (Bushli and Denzau, 1977; Borcharding, Bush, and Spann, 1977).

Consequently, considerable evidence exists that the model presented in Figure 1 is insufficient to capture the complexity of the

linked processes occurring in urban service delivery systems. Instead of a simple linear set of one-way relationships, the processes are better represented in the Quadrilateral shown in Figure 2. My colleague, Roger B. Parks, and I have started to develop a series of formal models of these interactive processes between the four major actors shown in Figure 2. Formal models of several of the processes have already been developed by others to explain interactions at the national level. Following the seminal work of Downs (1957) and Miskanen (1971), the processes of national representation among citizens and officials and of bargaining between officials and bureau chiefs have been extensively developed. Formal models of the bureaucratic process exist (Williamson, 1967), but have not been as extensively developed as those of representation and official-bureau chief bargaining. We have ourselves developed an initial model of the coproductive processes at a local level (Parks, et al., 1980).

Figure 2





Formal models of the four processes located around the periphery of the Quadrilateral exist and can be used as a preliminary base upon which to build analyses of the linked processes. Unfortunately, however, it is no simple matter to build an integrated model of the six processes shown in the Quadrilateral. Many problems need to be solved. First, we need to posit a general model of the individual that can be used for all four of the major actors in the Quadrilateral. Current models of the bureaucratic process assume that bureau chiefs maximize some single objective such as the agency's budget (Iliskanen, 1971) or a fiscal residuum (Orzechowski, 1977). Models of the representation process assume that elected officials maximize the probability of their being reelected and that citizens maximize their expected net gains from electing one team of politicians as compared to another team (Downs, 1957, and the extensive literature based on Downs).

Existing models of these processes posit actors who pursue objectives which relate to their being in a particular position in an institutional arrangement. An individual cannot pursue the objective of budget maximization unless that individual is located in an agency with some overall responsibility for the budget. An individual cannot pursue the maximization of the probability of being reelected unless they are already an elected official. Further, maximization of a single objective is an extremely limited assumption about the nature of human decision-making. To capture the complexity of the decision making process, we wish to posit a model of the individual pursuing multiple objectives rather than a single goal.

If we are eventually to develop a full model of the Quadrilateral, we need to develop a general model of the individual which is not institutionally specific. Then, we need to introduce the incentive system of each of the institutional settings so that individuals are posited to pursue objective events rather than internal and unmeasurable indicators. Eventually, we will use the same behavioral assumptions for all four actors in the Quadrilateral. Differences in their behavior will be attributed to fundamental differences in the institutional incentives they face rather than basic differences in the nature of the individuals involved.

#### The General Model of the Individual

Our general model of the individual is a person with a relatively stable, though not immutable, array of preferences. The objects of those preferences are, to borrow Gary Becker's language, "fundamental aspects of life, such as health, prestige, sensual pleasure, benevolence, or envy. . ." (1976: 5). Becker calls the objects of these preferences "commodities" to distinguish these from "goods." However, since the terms "commodities" and "goods" are used interchangeably to refer to the same objects, we prefer to call the objects of these preferences "end-states." End-states may include variables which directly impact on the specific individual being modeled (the referenced individual), on specific others (such as family or friends), or on generalized sets of other individuals (such as those living in a community, a nation, or even the world). These end-state variables may even represent complex relationships among

simple end-states such as preferred distributions of health and wealth to a group of individuals. Such complex relationships reflect different preferences concerning the justice or efficiency of the distribution of end-states.

End-states need to be distinguished from goods and services that may be purchased in the marketplace, obtained via nonmarket supply arrangements, or created with one's own labor. Goods and services are intermediate in nature, serving as inputs to the production of preferred end-states. Individuals are thought of as engaging in a two-step production process. First, they must produce income and other goods. Secondly, they must transform these goods, using additional resources, to produce preferred end-states. The process of producing preferred end-states may involve many steps, but it will be modeled here as involving a two-step production process.

The utility function of an individual is conceptualized as containing a large number of end-states ( $Z_1, \dots, Z_n$ ) which can be obtained given the constraints of: (1) the production functions relating end-states to inputs of goods, services, activities, and time devoted to production; (2) the total amount of time available to allocate along activities; (3) the total income potentially available for the purchase of goods and services; and (4) the set of allowable activities in which the individual may engage. The particular configurations of constraints which confront individuals in local service delivery roles will vary from role to role and, within roles, as a function of the structure of service delivery arrangements in which the individual is located. The form of the constraints will vary with the nature of the reward structure bearing upon each role.

The simplest<sup>2</sup> formulation of a utility function is thus:

$$(1) \quad U = U(Z_1, \dots, Z_n)$$

where  $n$  is the total number of end states assigned a positive or negative value by the individual.

### Incentive Systems

Having now developed a general model of the individual, we now need to develop a general way of thinking about the incentives individuals face within different institutional arrangements. Central to the concept of an incentive structure is that someone tries to induce someone else to undertake activities which the first person values -- by offering rewards to the second person. This process can be thought of in a general way as a principal-agent relationship. Ross (1973: 134) defines an agency relationship "when one, designated as the agent, acts for, on behalf of, or as representative for the other, designated the principal, in a particular domain of decision problems." The relationship is defined by a contract which specifies in more or less specific terms what services the agent is expected to perform and how these services will be rewarded.

### Principal-Agent Relationships

We will conceptualize each of the processes shown in the Quadrilateral as a form of a principal-agent relationship. We conceptualize both the principal and the agent as having considerable independence. One may act for the other in a particular domain.

Given divergences of preferences for outcomes, the agent may act in such a manner as to increase his or her own welfare at the expense of the principal. In developing the series of models, we will start with the principal-agent relationship in which the bureau chief is assumed to be the principal and street-level bureaucrats are the agents. We will now focus specifically on the bureaucratic process. But, the relationship between the bureau chief and elected officials can also be thought of as a principal-agent relationship in which the bureau chief is now the agent and elected officials are the principal. It is, of course, obvious that elected officials are themselves the agents of citizens as principals. Thus, while in the initial models the bureau chief will be viewed as a principal, in later models the bureau chief will be viewed as the agent of a set of principals.<sup>3</sup> The domain of decision problems included in the principal-agent relationship is the selection by an agent of the time to be devoted to different mixes of activities. Assuming that the principal and the agent do not value activities and their consequences equivalently, the agent will not automatically take actions which are in the best interest of a principal. Thus, a principal must try to design a system of inducements and deterrents to increase the resulting congruence of the agent's preference with those of the principal. Unless the principal can costlessly ascertain from a set of consequences which actions an agent has taken, the principal will also need to incur monitoring costs to reduce undesirable activities on the part of the agent (Mitnick, 1975; Jensen and Meckling, 1976).

Much of the literature on principal-agent relationships has been confined to the normative analysis of optimal contracts under varying

information conditions and preferences for risk (Ross, 1973; Harris and Raviv, 1978). This literature also focuses exclusively on monetary income as the only inducement offered by principals to agents. By contrast, the positive aspects of this theory is the focus used here. What incentives do individuals face in a bureaucratic setting and what behavior is generated under different types of incentive structures? Perverse as well as positive incentive systems exist and both types need to be modeled.

#### Entries in the Bureaucratic Incentive Structure

Agents in any institutional arrangement are rewarded or punished for the choices they make through the operation of an incentive structure. An incentive structure can be represented as a series of functions relating events in the world to end-states in the utility function. End-states, generally referred to as  $Z_i$  are related in bureaucratic processes to the following events in the world:

1. the tenure (T) of an agent in a position,
2. the income (Y) that an agent obtains from a position,
3. the activity set ( $A_j$ ) defined for a position held by an agent,
4. the discretionary budget(B-Cmin) of a public bureau in which an agent holds a position, and
5. the benefits residuum (R) of the agency or the difference between the benefits received by a community from the output of a public agency and the costs of providing these outputs.

All end-states ( $Z_i$ 's) may be affected to a greater or lesser extent by these events in the world. Thus, the relationship between an

end-state and these events may be stated as:

$$(2) \quad Z_i = k_i T [Y^{x_1} + A_j^{x_2} + (B - C_{\min})^{x_3} + R^{x_4}]$$

where,

$k_i$  = a scaling factor appropriate for end-state  $Z_i$ ,

$x_i$  = weighting coefficients ( $0 \leq x_i \leq 1$ ), and

$T, Y, A_j, B - C_{\min}$ , and  $R$  as defined above.

The events rewarded or punished may be outcomes, activities, or a combination of both. An example of an institutional reward tied entirely to outcomes is an employment contract in which wages are a function of the benefits residuum. An activity related reward system is an employment contract that specifies that workers will be paid wages for doing specified activities. A mixed reward system involves basic pay for specified activities and a bonus system based on profits. Each of the entries in the incentive structure of agents working in a public bureau will be discussed separately below.

However, before discussing the specific types of events that affect the end-states of value to individuals, three general topics about the variables in an incentive structure need to be discussed. These are the range, control, and weighting of the values of the variables in an incentive structure. In regard to the range of a variable in an incentive structure, the relevant question is how the range may be expanded or narrowed by institutional rules. In regard to control, the relevant question is how much relative control do agents or principals have over the value of an entry in an incentive structure. In regard to weighting (the  $x_i$ 's), the relevant question is what proportion of each weight is the result of an institutional arrangement and what proportion is the result of personal preferences.

Institutional arrangements affect incentive structures by the way they affect the range, control, and weighting of variables in the incentive structures.

#### The Range of Attainable Values of Variables in the Incentive System

The range of attainable values that a variable in an incentive structure may take is frequently set by the set of rules constituting the institutional arrangement. Institutional rules may set an upper and/or lower bound, a continuous variable, or define the set of included elements in an admissible set for a discrete variable. Thus, institutional rules may narrow or expand the range of a variable over which principals and agents may then have varying degrees of control. For example, the tenure variable usually ranges between zero and one. However, if a set of institutional rules preclude an agent from quitting and also preclude the principal from firing an agent, the tenure variable is set at one by the institutional arrangement. If the set of rules constituting the institutional arrangement is a contract between a particular principal and a particular agent, the contract will normally specify the range of such variables as the activity set and agent income. For example, the contract will specify which activities are expected of the agent and the minimum and maximum income the agent can receive. In the public sector the set of rules affecting the range of the variables in an incentive structure of a local public bureau may be located in state law, in local ordinances, and in collective bargaining agreements between a bureau and its agents. These rules particularly affect the range of the activity set and the income variable. Since the benefits residuum is a result of



the operation of an institutional arrangement, the range of the benefits residuum cannot be directly affected by institutional arrangements. The range of its values are indirectly affected by institutional arrangements as a result of the direct stipulation of the range, control, and weighting of the other variables in an incentive structure.

#### Control Over the Value of an Event

The question of control relates to who can determine a specific value or set of values of a variable within its range in an incentive structure. Four types of control are possible. First, the agent alone may be able to affect either a particular value or the entire range. Second, the principal alone may be able to affect a particular value or the entire range. Third, it may require the joint actions of the principal and the agent to determine the value of a variable. Fourth, the actions of the agent, the principal, and other variables may all affect the value of a variable.

An example of the first type is the control that an agent has in setting the tenure variable to zero if the agent wished to end a contractual relationship. Normally, an agent can quit. On the other hand, the principal may also have independent control to fire the agent. Thus, the principal can also set the value to zero. In this case, both the agent and the principal can set the tenure variable to zero, but neither can prevent (unless special contractual agreements are present) the other from setting the variable to zero. An example of the third type of control occurs when a piece-work contract is negotiated between a principal and agent. The principal sets the

amount of income to be earned for each unit of a final or intermediate product produced. In light of this action the agent's choice of the amount of work to be performed jointly determine the amount of income earned.

The fourth category of control occurs when neither the agent nor the principal, nor the two acting together can control the value of the variable. The benefits residuum, for example, is dependent not only on the actions of the principal and the agent, but also on the actions of many other persons and on such random and uncontrollable events as the weather. When activities clearly produce consequences, and rewards and punishments are strongly related to those outcomes, agents are able to control their rewards or punishments by choosing appropriate activities. If activities are only loosely linked to consequences, so that many others also contribute to the value of the consequence, a bureaucrat has only partial control over rewards and punishments related to consequences. The level of control may vary from almost none to very strong. Where the activities of a single agent do not have a major effect on outcomes, the institutional arrangements may reward or punish entirely on the basis of activities. In this case, a bureaucrat again has a higher level of control over the rewards and punishments received.

Frequently, control is conceptualized as the power of one person to make someone else do what the person would prefer not to do. This turns out to be a rather amorphous definition when one tries to measure power inside public bureaus. The concept of control as defined herein relates to the capacity to direct a value or set of values of a variable within an incentive structure. Thus, a principal

may control the full range of an income variable, but not the full range of the discretionary budget.

#### Weighting of the Values of an Event

Incentive structures are partially the result of institutional arrangements and partially of an individual's own making. To the extent that an individual gains utility from an event regardless of the rewards and punishments of the institution, the weighting of a value is of his or her own making. The satisfaction that a person gains from doing a particular task with a high level of skill is a reward weighted by the value system of the person and not a result of institutional arrangements.

To the extent that an agent is rewarded or punished by the principal for activities or consequences, that part of the weighting of a variable is established as part of an institutional arrangement. These aspects of an incentive structure are largely defined by a series of property rights which determine how the cost and rewards of different events will be allocated to the participants in an organization (Jensen and Meckling, 1976). Thus, each of the weighting coefficient  $x_i$ , are themselves composed of two components: the personal weight  $\emptyset_i$  and the institutional weight  $\theta_i$ ,

$$(3) x_i = \emptyset_i + \theta_i$$

The personal weights are affected by individual background factors, training, education, and level of individual professionalism. The institutional weights are the result of rules which set positive or negative sanctions related to the level of a variable. Union contracts specify, for example, how income is to be related to

activities or outcomes, which activities are to be included, and how such factors as seniority affect rewards. This analysis will focus on the various institutional mechanisms which weight the allocation of rewards and punishments more than on the personal valuation of events. However, in order to explain the effect of institutional arrangements one needs to take into account that the personal valuation of events also affects the relative weighting of a variable in a utility function.

In the sections below, each of these entries in an incentive structure will be discussed, and I will examine how institutional arrangements affect the range, control, and weighting of the variables in an incentive structure.

### Tenure

The tenure variable ( $T$ ) varies from zero to one depending upon the probability associated with an individual's keeping his or her position as an agent ( $T$  close to one) or not keeping a position ( $T$  close to zero). If  $T$  is zero, of course, no job related increases in end-states  $M$ ,  $P$ , or  $S$  are possible from a position. In most institutional arrangements, partial control over the tenure variable is shared by both the agent and the principal. The relative degree of control over the tenure variable is an important consequence of different types of institutional arrangements.

Control of the tenure variable by an agent is a basic "property right" related to employment. Except under slavery, an agent in most legal systems has a right to set the tenure variable at zero. Agents are allowed to resign from positions. Thus, if the utility derived

from material well-being, prestige, and activities falls below the expected utility to be derived from an alternative position (or a combination of home production and leisure) minus the costs associated with a shift in position, the individual quits. The capacity of an agent to quit is a fundamental limit on the power that a principal can exercise over the agent. However, if the rewards received in a particular position are considerably higher than those available in the next best option, an agent may be more exposed to the demands of the principal.

Lentz (1981) argues that the power of political bosses to gain political support from public employees is largely due to the differential in wages given to public employees under patronage arrangements. Public employees may become indentured when they lack opportunities to obtain comparable financial rewards in other employment. Public employee pension plans have become one method for offering higher benefits to public bureaucrats than available to them in alternative employment. Given that many public pension plans are not transferable, once a bureaucrat has served several years in a public bureau, the cost of leaving a particular pension plan may be very high.

While an agent has a right to set the tenure variable to zero, the agent does not have an unqualified right to keep the variable at one. Institutional arrangements usually assign principals more control than agents over whether the tenure variable is continued at one. While agents may quit a position, so long as they wish to continue to gain benefits from a position they must to some degree satisfy the requirements specified by a principal. For the purpose of

developing the concept of an incentive structure within a bureaucratic process, I will assume that agents desire to keep their positions. This enables us to focus on the effect that institutional arrangement may have on the relative control ( $C_{T-P}$ ) that a principal has over the tenure variable in an agent's incentive structure.

Tenure may be affected then by the relative control of a principal and by the variables used to evaluate agent performance  $b$ , the principal. The control by a principal ( $C_{T-P}$ ) is a variable which itself may vary from zero to one just as  $T$  varies from zero to one. If  $C_{T-P}$  is one, a principal has "absolute" control over tenure and can determine which events will be used to evaluate an agent. If  $C_{T-P}$  is zero, a principal has no control over tenure. Either some other officials (such as a civil service commission or locally elected official) has control over tenure, or the agent has full control over the full range of the tenure variable.

For the purpose of this analysis, let us assume two variables may be used to a greater or lesser extent by a principal to evaluate agent's performance when the principal has at least some control over tenure. These are the benefits residuum ( $R$ ) and the vector of activities assigned to an agent's position ( $A_j$ ). Stated generally, tenure is a function of the level of principal's control and the variables used by the principal to evaluate performance.

$$(4) \quad T = T(C_{T-P}, R, A_j)$$

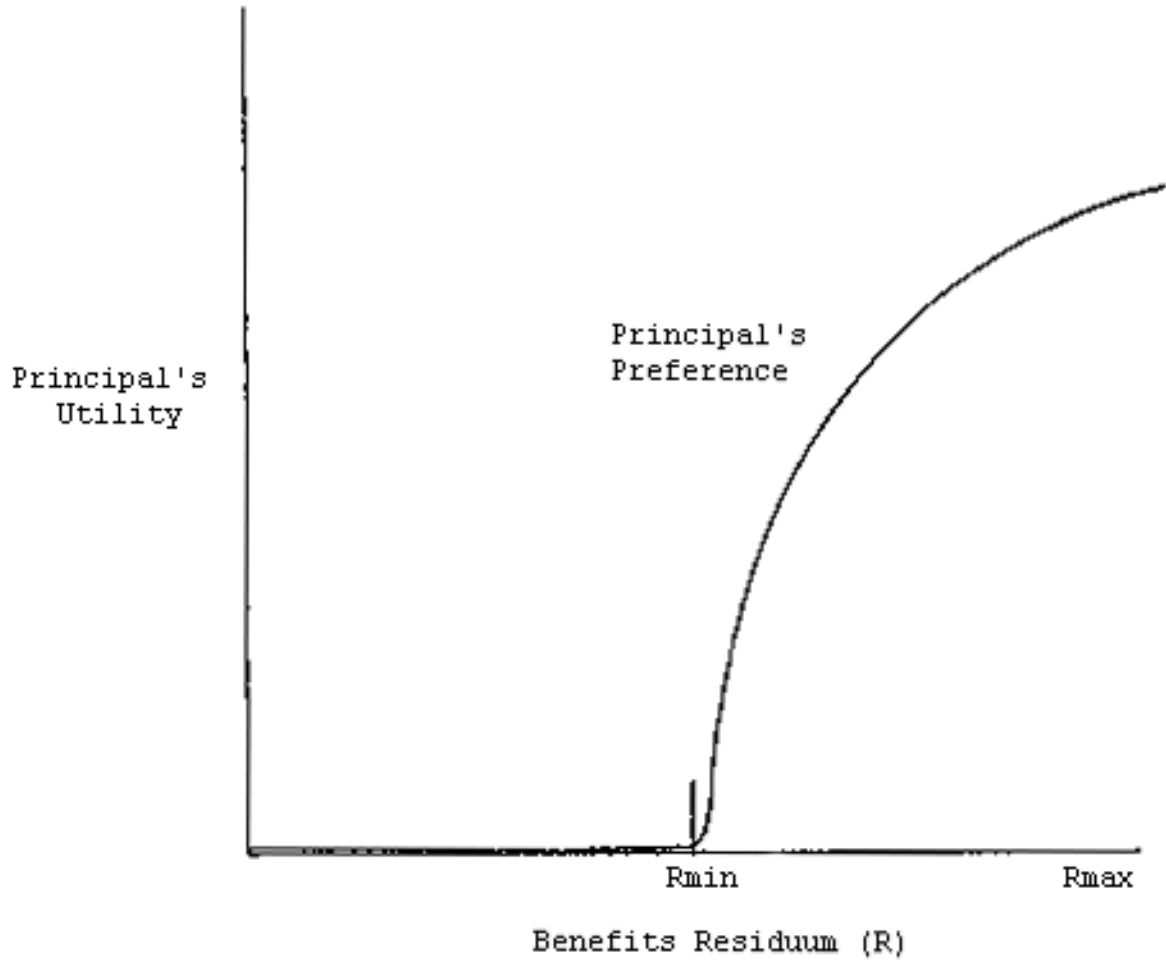
In a private firm without a union, bosses usually have considerable latitude to fire employees. In a profit maximizing enterprise, this enables managers to fire those employees who are less productive. In a highly competitive market, the manager of such a

private firm would have absolute control over the tenure variable and would use profits to evaluate agent performance. If a market is less than fully competitive, considerations other than those related to productivity may enter into the decision to fire as well as in original hiring decisions (Becker, 1957). In a public bureau where locally elected officials have absolute control over the bureau chief and evaluate performance by assessing the difference between actual benefits residuum and the maximal attainable benefits residuum ( $R - R_{max}$ ), the bureau chief in turn would attempt to set the tenure variable for bureaucrats located lower in the bureau to the same performance variable. In this case, tenure would be affected both by the level of control over it by the bureau chief and by the relationship of actual bureau performance ( $R$ ) to maximal attainable bureau performance ( $R_{max}$ ).

As shown in Figure 3, a threshold function may be the most appropriate representation for the preference of a principal for  $R$ . When  $R$  is low, the principal gains little or no utility. At some minimum level of  $I$ , the principal begins to derive utility. At  $R_{max}$ , the principal derives maximum utility. Given this type of utility function, the principal may wish to set a minimal acceptable performance level for an agent at the level where positive utility is derived. If  $C_{T-P}$  is zero, the principal cannot enforce even this level of minimal performance. The agent may keep the tenure variable at one even though performance is at  $R_{min}$ . If  $C_{T-P}$  is one, the principal can insist upon performance at  $R_{max}$  and fire any agent who does not help produce such a result. However, if  $C_{T-P}$  varies between zero and one (which would be the normal condition), then the capacity

Figure 3

Principal's Preference Related to Benefits Residuum

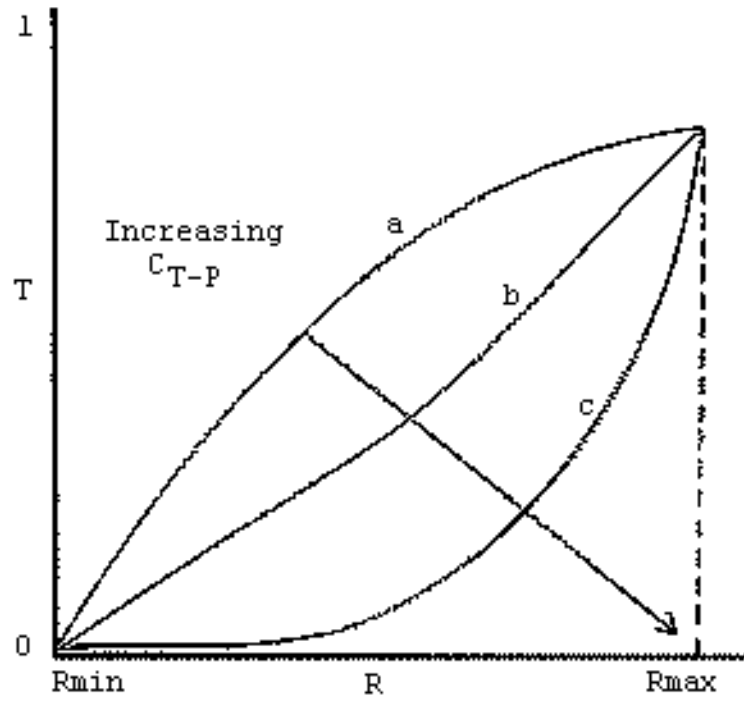




of the principal to set the tenure variable to zero depending on performance also varies. This is illustrated in Figure 4. If  $C_{T-P}$  is relatively high, the principal can set the tenure variable close to zero when performance drops slightly below maximal (line c). If  $C_{T-P}$  is relatively low, the principal cannot set the tenure variable close to zero except when performance has dropped close to the minimal acceptable level (line a). We are exploring specifying this relationship with a logistic equation.

$C_{T-P}$  is itself a function of a variety of institutional rules and the current state of the labor market. One of the important rules in the public sector is the presence or absence of a civil service system. Prior to the civil service movement, control of the tenure variable for most local bureau chiefs and street-level bureaucrats in public agencies was held by locally elected officials. Changes in the party of locally elected officials frequently meant that public employees hired by the other party were fired and new workers loyal to the incoming party were hired. Productivity as such was not the paramount reason for holding onto a job. Control by elected officials over lower bureaucrats would have kept the power of a bureau chief to discipline lower bureaucrats to a minimum.<sup>5</sup> Civil service legislation changed the relative property rights of public employees to their positions. No longer could they be fired at will or for lack of political loyalty and activity. After an initial probationary period had expired, a public employee could not be fired except for "cause." Civil service systems increased the power of bureau chiefs over street-level bureaucrats as contrasted with the patronage systems which protected incompetent bureaucrats at all levels if they had good

Figure 4

Principal's Control Over Tenure Variable

political connections. Civil service systems also increased the security of local bureau chiefs in dealing with locally elected officials. The general effect of civil service legislation is to limit the control that principals have over the tenure variable for all agents in systems covered by such legislation. Principals in the public sector where civil service legislation is present are, thus, generally more limited in their power to fire agents than principals in similar roles in the private sector.

The presence of collective bargaining agreements also affects the control that principals have over the tenure variable of agents. Under such contracts, the terms and conditions of an entire set of agents is negotiated at the same time. Grievance procedures are usually instituted to provide a forum and procedures for an agent who wishes to appeal a nonvoluntary termination. The principal may be forced to re-employ an agent or provide compensation, if the termination is not considered within the power of the principal by the grievance panel. This substantially alters the power of the principal to control the tenure variable. Contracts often specify rights to positions according to seniority which also limits the power of a principal to select which agents will be laid off during times of financial restrictions. Under seniority rules, the last person hired is the first to be laid off regardless of work performance.

Control by a principal over  $T$  is also affected by the labor market. If many individuals are eager to replace the agent at any particular time and they have the relevant skills desired by the principal, the principal has higher  $C_{T-P}$  than if few people with the relevant skills are available as potential replacements.

Income from a Position

The second entry in the bureaucratic incentive structure is income from a position ( $Y$ ). Since a major reason for working is to increase the end-state of material well-being, I will focus first on the relationship between wage income and material well-being assuming that wages do not affect other end-states such as prestige or activity satisfaction. Following Gronau (1977), material well-being ( $Z_M$ ) is affected by the combination of goods and services ( $X$ ) available to the individual and the amount of time devoted to leisure ( $t_L$ ).

$$(5) \quad Z_M = Z_M(X, t_L)$$

Goods and services are purchased in the market ( $X_M$ ), obtained through nonmarket provision ( $X_{NM}$ ), or are home produced ( $X_H$ ).

$$(6) \quad X = X_M + X_{NM} + X_H$$

All of these goods are valued at their market or market equivalent prices. Goods and services purchased in the market are constrained by the availability of income through employment or other sources of income. Thus,

$$(7) \quad X_M = wt_J + V$$

where,

$w$  = wage rate,

$t_J$  = time allocated to work in a job, and

$V$  = other sources of income.

Goods and services provided through nonmarket arrangements can be affected by spending time lobbying and other activities, but this possibility will be ignored for now. These will be assumed to be a given constant and thus do not affect further analysis. Goods

produced at home are a function of time spent in their production.<sup>6</sup>

$$(8) \quad X_H = f(t_H) \quad f' > 0, f'' < 0.$$

The activity set is thus defined as working on a job (J), working at home (H), or leisure (L). The time constraint is:

$$(9) \quad T = t_J + t_H + t_L$$

The relationship between the amount of goods available for consumption (X) and the use of time (T) for leisure or home production is shown in Figure 5 as an opportunity frontier. If a person spends all available time working at home, he or she can produce  $X_4$  quantity of goods and services. (I assume with Gronau that individuals do not have a preference for either market goods or home-produced goods as such.) If all time is devoted to leisure, only  $X_2$  quantity of goods and services is available for consumption. This is the level purchased with other sources of income ( $X_1$ ) plus the goods provided through nonmarket arrangements ( $X_2 - X_1$ ). If the current wage rate is not tangent to this opportunity frontier at a point other than a corner, the available time will be devoted to that combination of work at home and leisure that reflects the individual's relative preference for goods and leisure -- the two inputs into material well-being. This can be represented by the indifference curve  $I_1$ . If the wage rate were represented by the straight line  $w$ , the individual would consume leisure for  $T_1$  amount of time and would work at home for the remainder of the time. Such an individual would not be employed in a public bureau!

A higher wage rate expands the opportunity frontier available to the individual as shown in Figure 6. The wage rate  $w$  is now tangent to the opportunity frontier at A and the person can increase material

Figure 5

Goods Produced in Combination of Home Production and Leisure

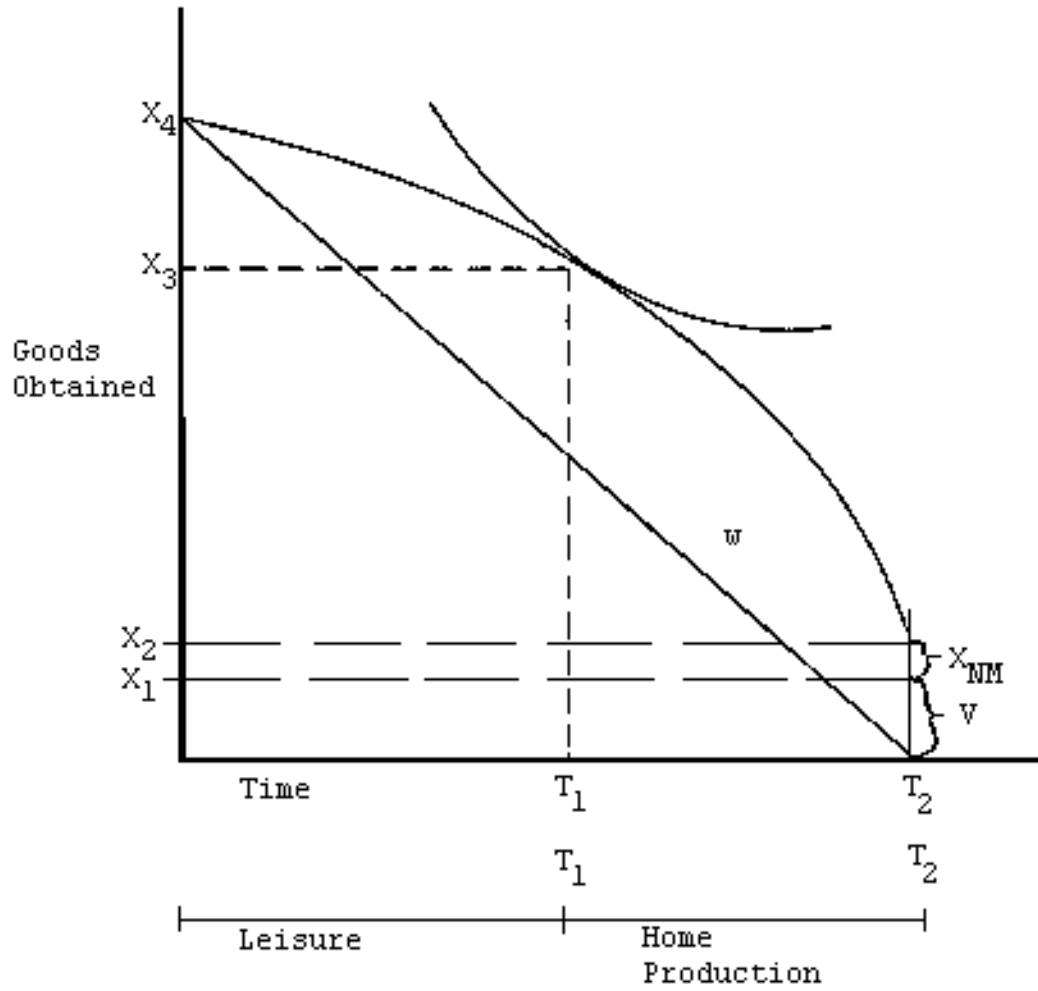
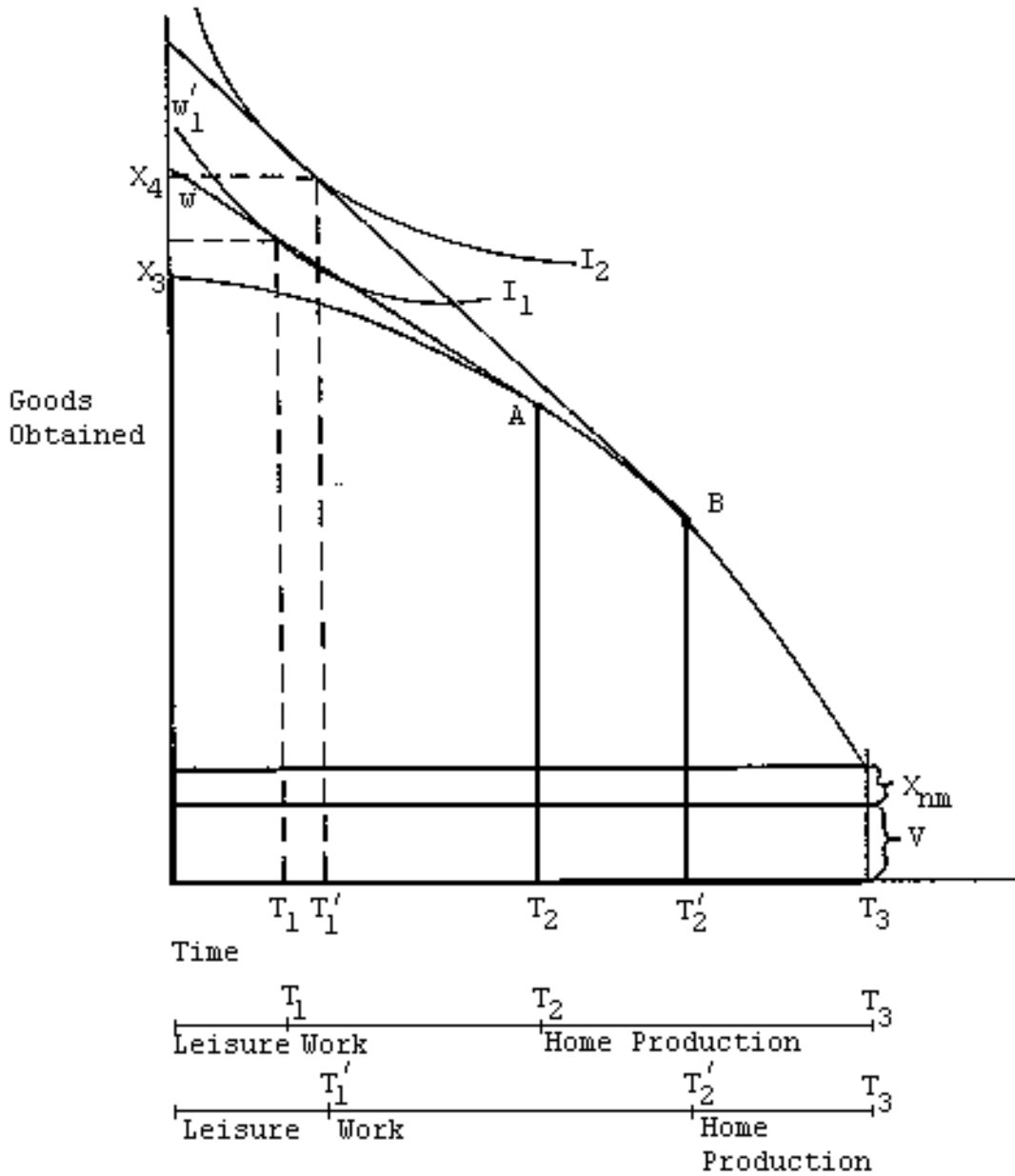


Figure 6

Goods Produced by Combination of Work,  
Home Production and Leisure



well-being by selling working time and purchasing a higher level of goods than could be made with the same time spent in home production. At an initial wage rate, an individual would obtain  $X_3$  of goods and services by spending  $T_1$  time in leisure,  $T_1 - T_2$  in a job, and  $T_2 - T_3$  time in home production. If the wage rate increased to  $w'$ , the price of goods is lowered in relation to the amount of time a person has to work to obtain them. This makes home production less profitable and may induce an individual to substitute some leisure time for work time depending upon the individual's relative preference for leisure. As shown, the individual would obtain  $X_4$  of goods and services by spending  $T_1$  in leisure,  $T_1 - T'_2$  in a job, and  $T'_2 - T_3$  time in home production.

Given stability in the technology of home production and leisure, once a person is efficient in these activities, material well-being can be increased through an increase in wages which shifts a portion of the opportunity frontier upward or through an increase in  $V$  or  $X_{NM}$  which shifts the entire frontier upward. In this analysis of bureaucratic behavior, I will ignore increases in  $V$  and  $X_{NM}$  and concentrate only on the relationship between wages and material well-being. It should be kept in mind, however, that a bureaucrat will not work for a wage unless that wage is high enough that it shifts the opportunity frontier between goods and use of time upward in return for selling working time. Thus, the basic reservation price of a bureaucrat is the opportunities foregone in home production when accepting a position.

If the individual has more than one opportunity to work, which most public bureaucrats have, a somewhat higher reservation price for



working in a public bureau is the wage offered by the next best available position assuming that the attributes of a position which affect other end-states, such as prestige, are similar. If a public bureau can offer substantial increases in status and an activity mix that is attractive to a prospective employee (and these are relatively important to an individual), the bureau may be able to attract a prospective employee for a lower salary than when status and job enjoyment are negatively affected.

Income from a position ( $Y$ ) is defined as the expected present value of the flow of current and future wages from a position. How wages are determined is affected by the type of contract between a principal and an agent. Under a piece-work contract, a principal hires an agent to produce some intermediate or final product and pays the agent in direct proportion to the quantity of output produced. This type of contract clearly relates wages to the consequences which a principal desires to accomplish. The agent is usually free under such contracts to decide how much time to devote to producing goods for the principal and at what pace.

Most production within both private and public firms is not organized using piece-work contracts that relate wages directly to the amount of output produced. Wages are more frequently related to the time spent in undertaking particular mixes of activities. There are many reasons for this. Piece work can most effectively be used when the production function is separable. Separability of a production function implies that each input contributes to output in only an additive manner. Portions of the production process can easily be contracted out. While some inputs in a production function may be

related in an additive fashion, others may be related in a nonadditive fashion in which output is greater (or less) than the sum of the contributions of inputs.

Alchian and Demsetz (1972) use the assumption of nonseparability to define a general type of production function which they call "team production." Their classic example is of two men jointly lifting heavy cargo into trucks. The work produced at the end of the day is more than the sum of what each man working individually could have lifted. If a principal hired them to work independently, the principal would not receive as much output as hiring them to work in a coordinated fashion. However, once they work in a coordinated fashion, they both contribute to a joint output. Determining how much each contributed to that joint product is a more difficult task for the principal than if they work independently and are paid for the amount of work they accomplished independently.

Given that the output of many public bureaus is collective in nature and difficult to measure, team production of such output makes piece-work contracts extremely difficult and costly for a principal to use. Devising a wage system that matches the amount an agent contributes to output is not a trivial problem. The transaction costs involved in rewarding time spent in a specified set of activities may be less than the transaction costs involved in trying to allocate income by marginal contributions to output. This is particularly the case when environmental conditions change requiring adjustments of production activities to meet changes in the availability of other productive inputs or to modify the output itself in light of changing demands. Each change would require a new contract specifying the wage

rate at which a particular intermediate or final output would be rewarded. Uncertainty is a second major reason for basing wages within public bureaus on more general employment contracts than on specific, contingent claims contracts related directly to consequences or outputs.

In public bureaus, employment contracts usually relate the income of an agent to the time spent by the agent on activities considered by the agent and the principal to be work activities ( $t_w$ ). Institutional rules (IR) such as those related to seniority and training may also affect income. Thus,

$$(10) \quad Y = Y(A_j, t_w, IR)$$

#### Activities

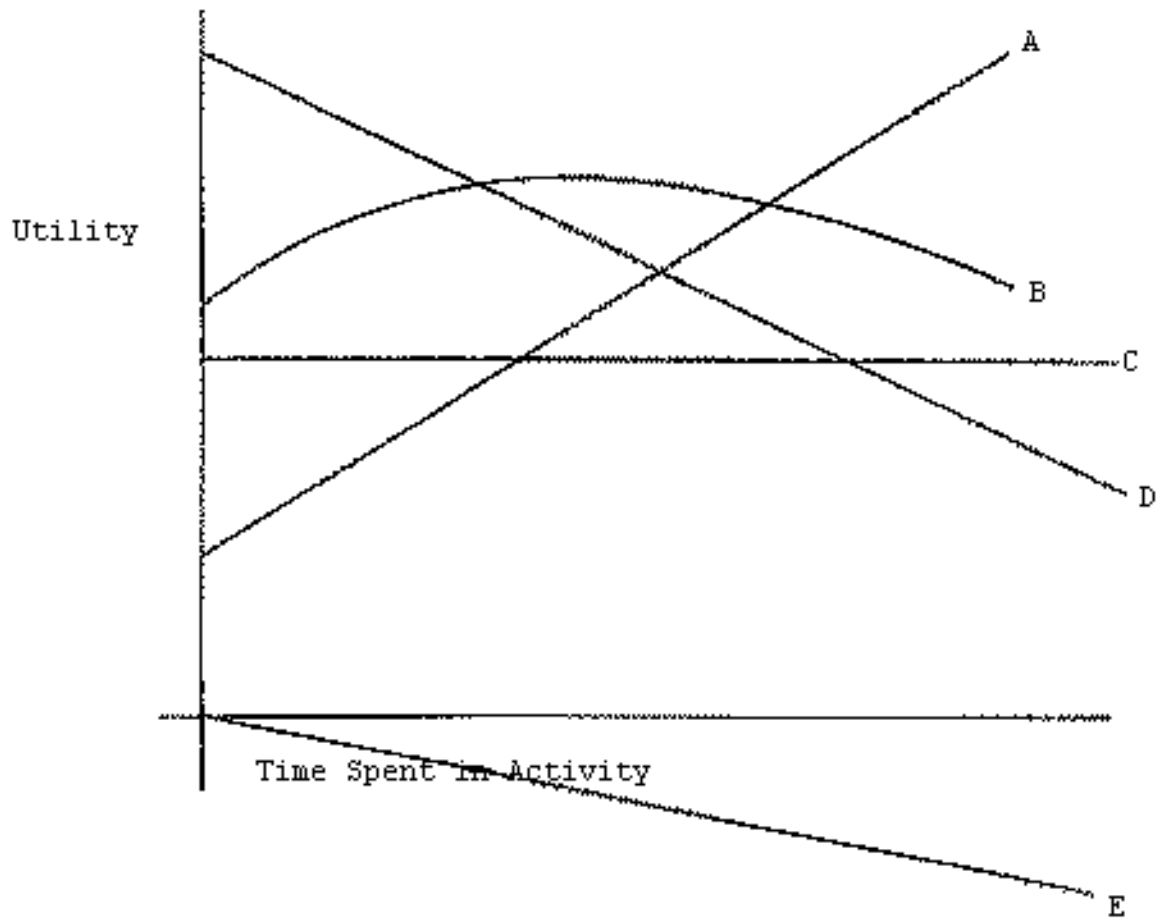
The next entry in the equation system describing an incentive structure is the vector of activities ( $A_j$ ) that agents undertake in a position. End-states such as material well-being, prestige, and activity satisfaction are affected by the choices that agents make about which activities to undertake. When principal-agent relationships are located within established public or private firms, the vector of activities is normally defined for the position that a particular agent holds in an agency. The activity set is partially defined in an employment contract and usually redefined and modified over time as individuals work together and develop mutual expectations about what is expected. Agents usually have considerable discretion to interpret their position and select a mix of activities to undertake (Leibenstein, 1976). However, how agents spend their time on different activities is not a matter of indifference to the agent or

the principal. The agent and principal may value activities differently.

The potential set of relationships between different mixes of work activities and an agent's utility is as large as the set of potential relationships between all commodities and utility. In Figure 7, five of the more typical utility-activity relationships are arrayed. Line A represents an activity which brings ever higher levels of utility to the agent the more time that is spent devoted to it. Line B represents an initial positive relationship as the first amounts of time are devoted to the activity, but beyond a certain point some diminishing marginal utility per unit of time spent in the activity sets in. Line C represents a constant level of utility derived from an activity unaffected by the amount of time devoted to it. Line D represents diminishing marginal utility per unit of time spent in the activity from the first unit of time spent, but utility does stay positive for the range illustrated. Line E is a variant of the same type of negative relationships in which utility is never positive even when only a small amount of time is devoted to the activity. An activity related to utility as illustrated by Line E would be considered unpleasant. If the disutility was large, the activity would be considered noxious.

If agents have considerable choice concerning the positions they accept, one would speculate that many of the activities to be undertaken as part of work would have a relationship to utility similar to that of Line B. Individuals offered similar wages to perform liked versus disliked activities will select those positions which for a given wage include a larger proportion of liked to

Figure 7

Typical Relationships Between Work Activity and Utility

disliked activities. Most agents also have positive preference for variety in the activities they undertake and obtain increasing utility from the first units of time allocated to a new activity. Since activities are frequently carried out in mixed proportions, we would expect that a similar relationship would hold for many combinations of activities.

When a mix of two activities are involved, the utility surface is shown in Figure 8 and may be thought of as an upside-down bowl.<sup>7</sup> Time is represented by the parallel lines labeled  $T_1$  through  $T_6$ . Each time-budget line represents a defined period of time that could be devoted entirely to Activity A, entirely to Activity B, or to any combination of these two activities. If an agent has total discretion to select both the amount of time to devote to these activities and the proportion of each activity to be undertaken, and all other factors were held constant, the agent would select a time and activity mixture that would place him or her on the highest plane of the utility surface. The locus  $OI$  of tangencies  $I_i T_i$  indicates the optimum activity mixtures for different time budgets for an individual. The locus of most preferred activities in terms of utility is arranged in Figure 9 where time allocated to work activities is arrayed as a continuous variable along the horizontal axis.

Figure 9 illustrates what may be considered a relatively typical utility-activity-time relationship. Most bureaucrats would probably rather spend time on work activities than do nothing. However, after a period of time has been devoted to any particular mix of activities they tend to become onerous rather than pleasurable. Thus, up to some

Figure 8

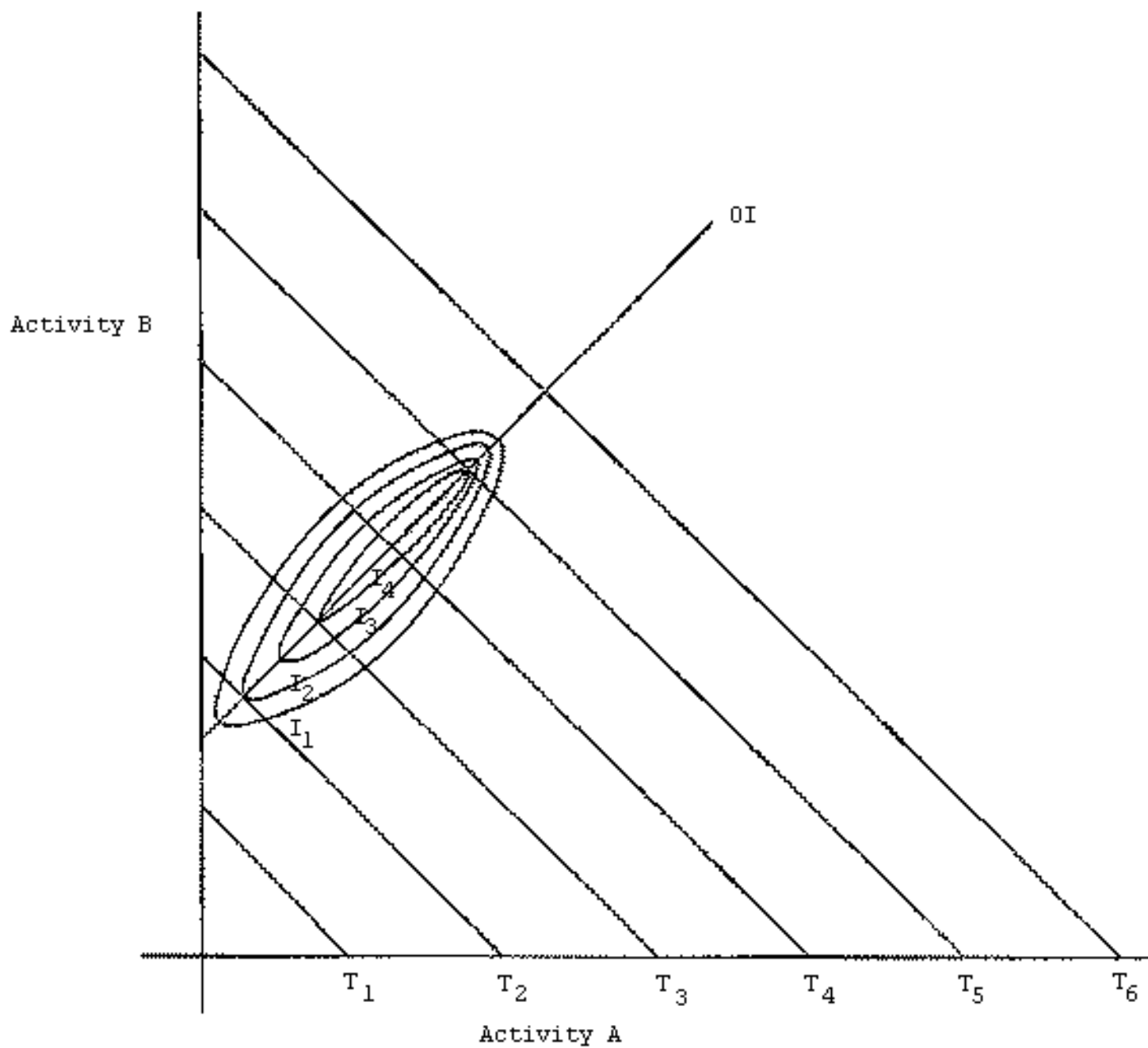
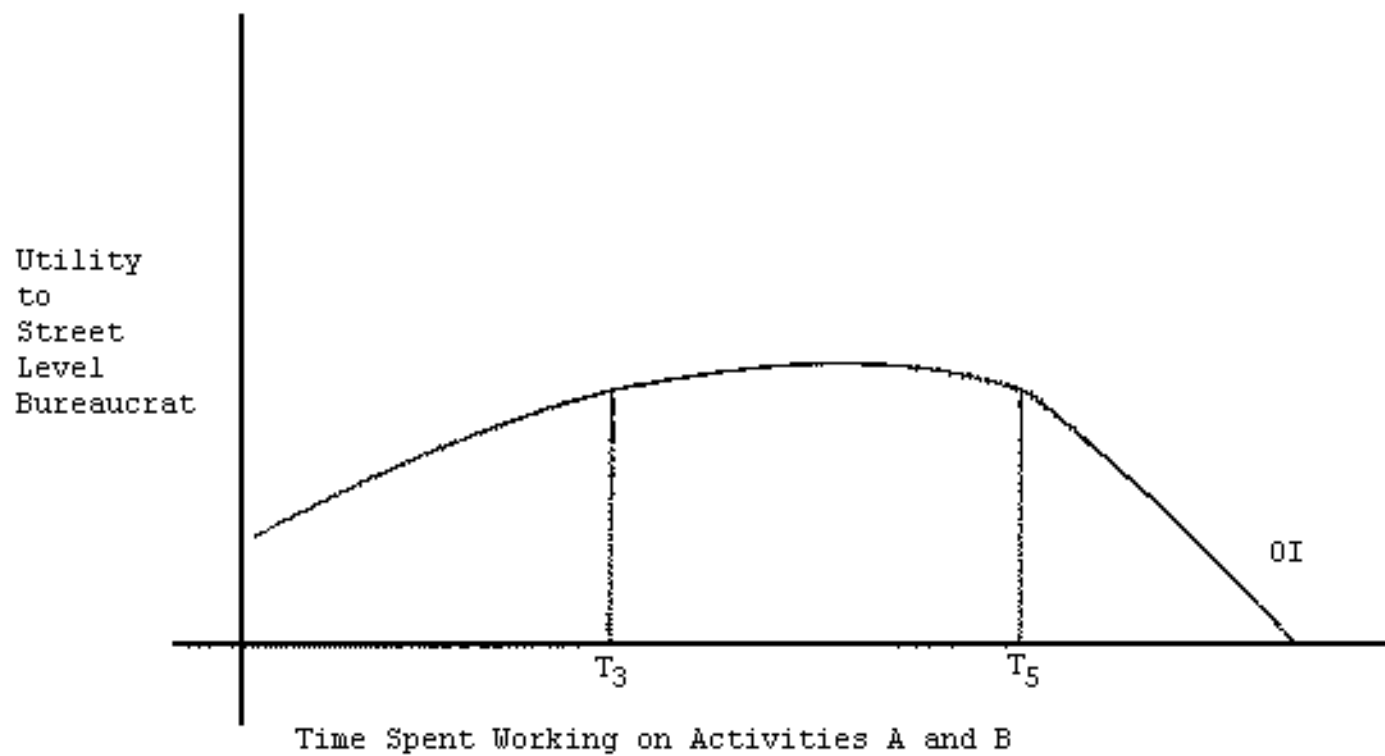
Relationship Between Activity Mix and Utility

Figure 9

Utility from Optimal Mixture of Activities A and B



point, work is enjoyed for its own sake, but the same activities continued for a long period of time tend to reduce utility rather than add to it.<sup>8</sup> What has been illustrated so far is the importance of the  $\emptyset$  component of the  $x^2$  coefficient of  $A_j$ . This part of the incentive structure relating activities to rewards and punishments is under the direct control of an agent. It reflects his or her own preference for different kinds of activities independent of the  $\theta$  component reflecting institutional rewards and punishments. If the activity mix which produces the highest level of utility for an agent happens also to be the activity mix which produces the highest level of output for a principal, the personal weighting and the institutional weighting would be consistent. Both would encourage maximum productivity by an agent.

To illustrate that this may not always be the case, let us examine the situation when a principal wants an agent to maximize production of output ( $Q$ ), but the most preferred mix of activities from the preference structure of the agent is another combination of activities. In Figure 10, the same activities and budget lines are arrayed as in Figure 8. However, in Figure 10, the isoquants of a particular output for increasing time allocations devoted to a mix of Activities A and B are identified. The locus  $OQ$  of tangencies  $Q_iT_i$  indicates the optimum activity mixtures for different time budgets in terms of increases to the quantity of output.

When the iso-utility surface and the isoquant surface are both arrayed in the same activity-time space, the disparity between the most preferred mix of activities from the perspective of an agent and a principal is more obvious (see Figure 11). If the agent were able

Figure 10

Relationship Between Activity Mix and  
Quantity of D-Output Produced

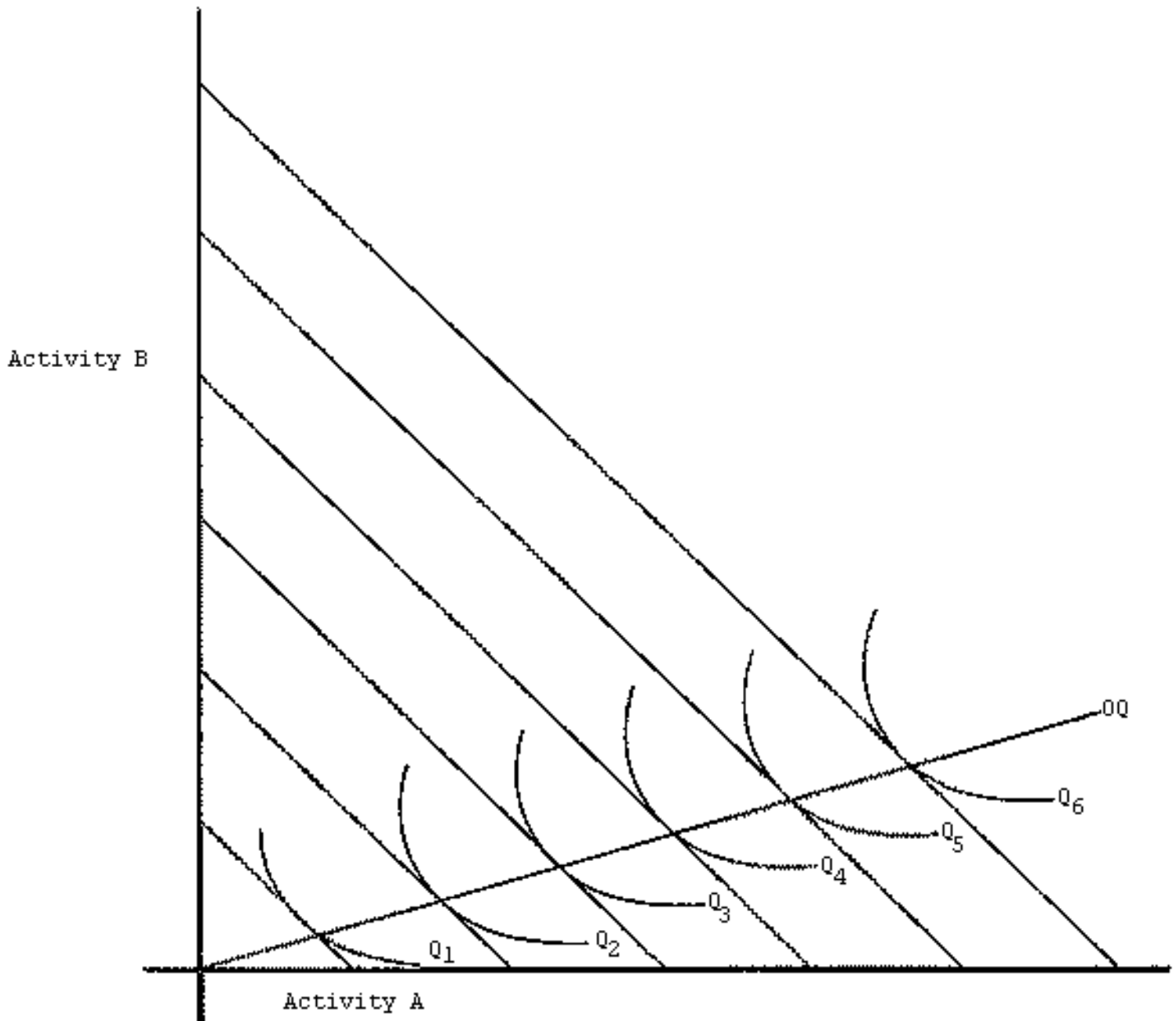
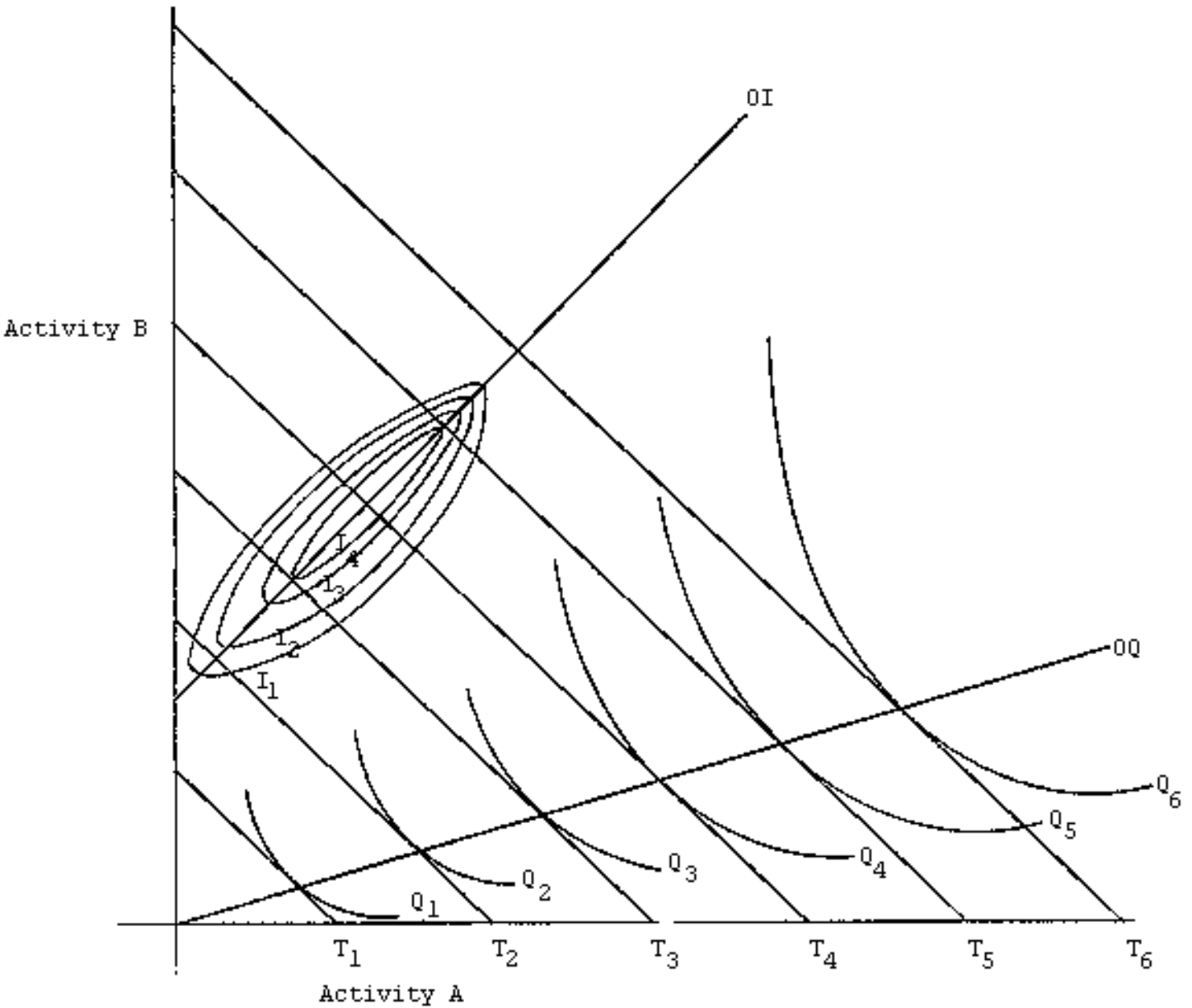


Figure 11

Divergence of Optimal Mixes of Activity in Terms of  
Utility to Street Level Bureaucrat and Amount of D-Output Produced



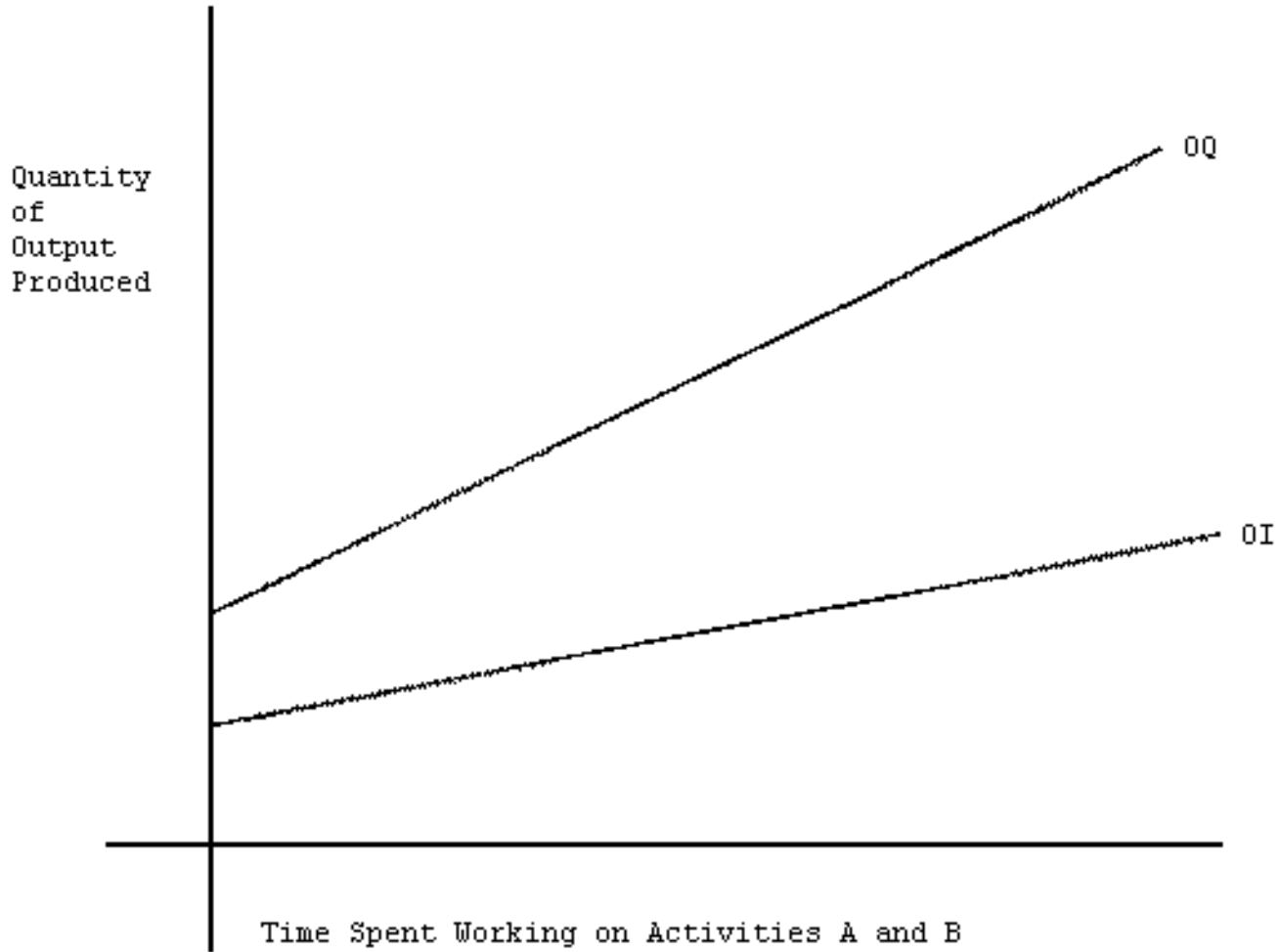
to pursue his or her own most preferred combination of activities, the agent would produce less output for every unit of time devoted to work than if the agent pursued the optimally productive mix of activities. In Figure 12 the difference in the quantity of output produced when either of the two optimal strategies are followed is illustrated. Line OQ is the locus of points associated with the optimal productivity of the output while line OI is the locus of points associated with the optimal productivity of utility from the activity itself.

An agent may also have a preference for one or more activities which do not contribute at all to productivity of Q or may even reduce output. A patrol officer, for example, may gain positive utility from sleeping for several hours during the night shift. One could hardly argue that this activity produces positive service for the community. A patrol officer who accepts a bribe or uses excessive force may actually contribute in a negative fashion to output. When nonproductive or counter-productive activities are undertaken, the divergence between the preferred activities of the agent and the principal are considerably greater than those illustrated in Figures 11 and 12.

The principal's problem is how to affect the  $\theta$  component of  $x_2$  to encourage agents to shift from a less productive mix of activities to a more productive mix. However, in a public service agency, it is extremely hard to devise effective positive or negative rewards tied directly to activities. Income is rarely related directly to the mix of activities selected by an agent. Agents are normally paid a set wage so long as they appear to be performing job related activities at

Figure 12

Quantity of Output Produced



least at some minimal level. The word "appear" is used in the above sentence because principals cannot observe all activities of agents and must rely upon some "estimator" of the amount of effort expended by an agent (Harris and Raviv, 1978). Estimators of effort vary greatly in accuracy. Many of the estimators used in urban policing are sufficiently under the control of an agent to be relatively inaccurate estimators of effort. If miles patrolled during a shift is used as an estimator, an officer can go to the nearest freeway and drive sufficient miles in the first hour of work that he can relax for the rest of the shift. Even when a specific output is used as an estimator of effort, such as number of traffic tickets, an officer can "produce" traffic tickets relatively rapidly during the early hours of a shift and reduce effort throughout the remainder. The quality of work produced under such circumstances may not approximate what a bureau chief desires. Tickets produced simply to meet a minimal quota may contribute primarily to citizen hostility toward the police rather than to the output of traffic safety. In general, the more importance attached to recorded estimators of effort by a principal, the more agents will undertake those activities which are recorded and monitored by the principal. This process can evolve into one of producing statistics for the record with little regard for how such activities affect outputs.

Promotions are another positive reward potentially available for stimulating agents into a more productive mix of activities. However, the promotion process in many public service agencies has become highly structured and dependent upon seniority and written examination. If dependent strictly on seniority, promotions may

reward those who have successfully evaded detection of less productive or nonproductive use of their time. If dependent primarily on written examinations, promotions may reward those who are highly skilled in taking examinations regardless of the mix of activities they have selected in their prior work. Supervisor rating schemes are frequently used in public service agencies in efforts to reward those who have worked hard and effectively when individuals are selected for promotion. However, whether such schemes do achieve their purpose depends on the skill of a principal in observing agents on the job, in the validity of the estimators of effort used, and the reliability of the supervisor's estimates.

Negative sanctions include loss of pay for "infractions" of agency rules or even loss of job when such infractions are serious. Whether the threat of such penalties is effective in changing the activity mix selected by agents depends upon whether there is a high likelihood of being apprehended in rule infraction and a high likelihood of a substantial penalty being imposed. The logic of the situation is similar to that of a criminal selecting a bundle of legal and illegal activities depending upon estimates of the probability of apprehension and size of penalty (Ehrlich, 1973). Thus, in many urban police agencies there may be a "cops and robbers" game going on inside the agency as well as between the agency and those in the community engaged in illegal behavior.

#### Discretionary Budget

The discretionary budget is the first of the two "outcome" variables included in the incentive structure. Both of these

variables are likely to have more impact on the end-states of bureau chiefs than on the end-states of street-level bureaucrats. The discretionary budget is composed of two terms:  $B$  and  $C_{min}$ . The budget of an agency ( $B$ ) in the private sector would be determined as a direct result of the actions of many consumers who purchase the output of a firm.  $B$  is equivalent to total revenue in a private firm which is simply  $P \times Q$  where  $P$  is the price of the good. In a public agency,  $B$  is equal to the annual budget assigned to a public bureau supplemented with whatever additional funds may be made available during the course of the year (or taken away). How the budget is related to the amount of output ( $Q$ ) and the benefits residuum ( $R$ ) depends on the type of bargaining between a bureau chief and sponsoring officials. For the time being, let us simply assume that  $B=f(Q, R)$ .

$C_{min}$  is defined to be the minimum costs of operating an agency producing a defined level of output when the agency is technically efficient. It is usually assumed that a private firm in a highly competitive environment will be forced to operate at  $C_{min}$ . In such a case,  $B-C_{min}$  is the equivalent to the profits or residual to be divided between owners and managers. For a public bureau chief, the discretionary budget can be thought of as management slack. This slack can be allocated to the employment of more staff than minimally required to produce a particular level of  $Q$ , to more expenditures such as travel, or to overinvestment in technology for the  $Q$  being produced.

Alternative uses of a discretionary budget may have differential effects on a bureau chief's end-states such as material well-being,



prestige, and activity satisfaction. If management slack is absorbed through the hiring of excess personnel, the bureau chief's income will be affected due to the high relationship between number of employees and bureau chief's salary. A chief may derive even more satisfaction in the form of prestige from investments in specialized personnel and staff assigned to help with the administrative load.

In regard to hospitals, Lee (1972: 85) has argued that "inputs are used as status symbols, or, in other words, the pattern of input utilization defines the status group to which a hospital belongs." He also argues that hospital managers participate in a "keep up with the Jones's game" in that the "desired inputs of, say the  $i$ th hospital is assumed to be a function of the inputs utilized by other hospitals" (Lee, 1972: 85).

Police chiefs also derive considerable status and recognition for investing in specialized personnel. Having their own homicide investigation bureau, bad check or arson team, dispatch facility, crime, and entry-level training academy adds to the status, and, thus, the utility of an urban police chief. The sworn personnel assigned to administration significantly lighten the workload of a chief and also contribute to his material well-being and prestige. Thus, the discretionary budget will be conceptualized as composed of three components:

$$(11) \quad B - C_{min} = (L - L_{min}) + (V - V_{min}) + (F - F_{min})$$

where,

$L$  = labor costs,

$V$  = other variables costs other than staff, and

$F$  = fixed costs.

Miqué and Belanger (1974) have pointed out that suppliers of factor inputs are not totally indifferent to how a bureau chief allocates B-Cmin. One would predict that in a unionized bureau, a bureau chief would be pressed in negotiations so as to have more discretionary budget to allocate to the employment of more staff or to higher wages. Street-level bureaucrats may thus weight L-Lmin more than the other elements in the discretionary budget. The bureau chief may personally favor such a shift to more personnel given the strong relationship of size of staff to a bureau chief's own salary. Bureau chiefs are also lobbied by manufacturers of the latest technology in their field.

#### The Benefits Residuum

The concept of a benefits residuum is the public sector equivalent to consumer surplus in the private sector (see Parks and Ostrom, 1981). It is defined as:

$$(12) R = \sum_{i=1}^n v_i Q_i - C$$

where,

$v_i$  = the average per unit valuation of output  $i$  across citizens of the providing governmental entity,

$Q$  = quantity of a specific output produced by a public agency, and

$C$  = total cost of providing the sum of the  $Q$ 's.

The benefits residuum is related to end-states through the increased probability of job retention, advancement, and prestige associated with a positive consumer surplus among those served by the bureau and from personal satisfaction with serving the public well. Many local urban service bureau managers live in the community they

serve and consume the output of their own bureau. A local public service bureau chief will want to gain confidence and appreciation from citizens served and from friends, family, and neighbors for creating a positive consumer surplus.

The relative weight given to the discretionary budget versus the benefits residuum in a bureau chief's incentive structure will depend to a large extent on the institutional arrangements affecting the bargaining between bureau chiefs and providers. Bureau chiefs must negotiate with providers on a regular but infrequent basis (sometimes once a year), for authorization to spend a lump sum over a defined period of time. Niskanen argues that the nature of the relationship between a bureau and the officials of a providing organization frequently approximates that of a bilateral monopoly. Given that officials of providing organizations frequently have no other potential supplier of bureau services, bureau managers may gain the "same type of bargaining power as a profit-seeking monopoly that discriminates among customers or that presents the market with an all-or-nothing choice" (Niskanen, 1971: 25).

If officials of the providing organization are unwilling to forego the bureau's services, they may be at a disadvantage in the negotiation over the amount of budget to be approved for a bureau. If the bureau is able to conceal information about its production and cost functions while obtaining substantial information about the demand characteristics of members of the provider's constituency, the bureau chief's capacity to confront providers with a take-it-or-leave-it proposition is enhanced (Stockfish, 1976). This capacity is further enhanced when no competitive or potentially competitive

proposals are forthcoming, either from alternative suppliers or from comparative analyses by providers of the proposals offered and accepted in other, similar situations.

Institutional arrangements linking the provider and the bureau (and, where applicable, other potential suppliers) will affect the relative bargaining strengths of each. The situation is not fully determinate as in Niskanen's first model (1971), but rather will depend on these relative strengths (Breton and Wintrobe, 1975; Niskanen, 1975). In addition, the role of constituents or consumers as they constrain provider behavior through elections and other means must be considered in fully developed models (see MacKay and Weaver, 1978, and Langbein, 1980, for models incorporating consumers as voters).

#### Conclusion

In this paper I have described how we have taken the first two steps in developing a series of models to represent the Quadrilateral shown in Figure 2. These are only two steps of a long and difficult series of steps that must be taken. However, we now have a general model of the individual which can be used for bureau chiefs, street-level bureaucrats, elected officials, and citizens. Secondly, we now have described one of the incentive systems involved in the Quadrilateral -- the bureaucratic incentive system. This incentive structure has been broadly conceptualized as a transformation that links individual preferences for internal end-states to events in the world which can be obtained within a particular institutional

arrangement. While we have developed it primarily to represent the incentives faced by street-level bureaucrats, the same structure can be used to represent the incentives faced by the bureau chief in relating to elected officials. Thus, we have completed the task of representing two of the incentive structures we need to model before we have completed our longer-term task.

In this paper, I hope I have also shown how institutional arrangements affect which variables are present in an incentive structure, their range, their weighting, and who has control over them. Thus, institutional arrangements are conceptualized quite differently than one variable added to others in a multiple regression equation. Rather, institutional structures are conceptualized as fundamentally affecting the structure of an equation itself rather than being internal to an equation.

Another aspect of our on-going effort that I have attempted to illustrate is a way to conceptualize the "public interest" and bring such a notion into models based on the preferences of individual actors. The notion of the benefits residuum has been more thoroughly described elsewhere (Parks and Ostrom, 1981), but it is used here as a key part of the incentive structure facing both street-level bureaucrats and bureau chiefs. We will later focus on the relative control by principals over tenure and the possibility of rewarding agent performance as a function of the level of the benefits residuum as we compare the effect of different institutional arrangements on performance in the public sector.

Since this is a progress report on the beginnings of a long and difficult theoretical enterprise, I cannot establish that the models

which will be developed based upon these foundations will be better than the simple models of urban service delivery systems that I criticized when I began this paper. However, I hope that the reader will agree with me that it is better to "tame" the jungle of complex relationships existing in metropolitan areas by developing models of that complexity rather than simply to criticize the complexity and then to try to tame it by eliminating it.

### Footnotes

<sup>1</sup>The next two sections of this paper draw extensively from a joint paper with Parks entitled, "Modeling Complex Urban Service Delivery Systems," delivered at the 1981 American Political Science Association Meetings in New York.

<sup>2</sup>Far more complex formulations may be useful when one is particularly interested in exploring the effects of interdependent utility functions. See Danielsen, 1975, for an example of interdependent utility functions.

<sup>3</sup>The bureau chief might also be thought of at times as an agent of street-level bureaucrats. This is particularly the case when the bureau chief bargains with elected officials to increase the total budget of the agency. The wages of lower bureaucrats are dependent upon the skill of the bureau chief in obtaining the highest possible budget from elected officials. While I recognize this added complexity, I will not attempt to build it into the initial models.

<sup>4</sup>This is a strong assumption. It implies that the net rewards flowing from this position for the agent are higher than the next best alternative position. To the extent that an agent has viable external alternatives, the option to quit enables the agent to limit the exercise of arbitrary control by a principal.

<sup>5</sup>In discussing the nineteenth century control of local bosses over police captains in U.S. cities, Rubinstein (1973: 23) notes:

From the beginning the district has been the basic unit of police organization. In the nineteenth century the districts frequently had the same boundaries as the wards, which were the basic administrative and political units of city government. Each district was headed by a captain, who often was appointed by local political leaders. Nominally under the direct command of the police chief, many of these captains were virtually independent of their superiors and answered directly to local political bosses. In some cities there were captains who became millionaires as a reward for their role in the nonenforcement of the liquor, gambling, and prostitution laws. The decline of the locally based political machines has allowed the American police to exert greater control over the selection and supervision of their district captains.

<sup>6</sup>For purposes of this analysis the value added to XI by market goods or by nonmarket provided goods is considered to be negligible. This assumption will need to be dropped in later analysis.

<sup>7</sup>The following discussion of activities and times draws heavily on the ideas of Leibenstein (1976).

<sup>8</sup>The relationship between utility and any mix of activities holding time constant while changing levels of pace or quality will be relatively similar (see Leibenstein, 1976). For any defined unit of time, an agent may enjoy working at a somewhat faster rather than

slower pace. Police officers frequently complain about the boredom of a slow night when few calls for service are transmitted by the dispatchers. However, if the calls come too rapidly, the same officers also complain about the pace and may find means to slow down their own response to the increasingly rapid demands for response. Utility from pace may also be related to the pace that other individuals are working. Any particular street-level bureaucrat may be primarily concerned that his or her own pace should be approximately equal to rather than slower or faster than those sharing the same job assignment. Increasing the demands for careful and meticulous work may also produce a similar relationship. Holding time and pace constant, an agent may derive positive utility from increasing the quality of the work performed as adding to the meaning of their work. However, as demands for ever increasing attention to small details increase, pressure on the agent may lead to a decrease in utility.



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