ORGANIZATIONAL CAPACITY*

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Abstract

Organizational capacity is critical to the effective implementation of policy. Consequently, strategic legislators and bureaucrats must take capacity into account in designing programs. This paper develops a theory of endogenous organizational capacity. Capacity is modeled as an investment that affects a policy's subsequent quality or implementation level. The agency has an advantage in providing capacity investments, and may therefore constrain the legislature's policy choices. A key variable is whether investments can be "targeted" toward specific policies. If it cannot, then implementation levels decrease with the divergence in the players' ideal points, and policy-making authority may be delegated to encourage investment. If investment can be targeted, then implementation levels increase with the divergence of ideal points if the agency is sufficiently professionalized, and no delegation occurs. In this case, the agency captures more benefits from its investment, and capacity is higher. The agency therefore prefers policy-specific technology.

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1. Introduction

In many policy environments, the quality and extent of a law's implementation are of primary concern. Beyond the passage of legislation, outcomes depend on the responsible agency's training and allocation of personnel, its research and development of technology, and its collection of data. In the American system, outcomes also depend on its handling of the rule-making process, which poses extensive procedural hurdles. These activities, among others, are components of an agency's organizational capacity. Capacity determines whether regulations are enforced, revenues are collected, benefits are distributed, and programs are completed. It therefore plays a key role in the success or failure of policies and the bureaucracies that implement them.

Observers have long noted that organizational capacity varies greatly across agencies (*e.g.*, Barrilleaux et al. 1992). Historically high capacity agencies such as the U.S. Forest Service have enjoyed political clout and autonomy, while low capacity agencies have languished (*e.g.*, Kaufman 1960, Skowronek 1982). This variation raises two related questions. First, what are the sources of organizational capacity? Second, how does capacity affect policy-making?

A central argument about the origins of capacity is that it arises from within the bureaucracy.[1] In many cases, successful agencies invested strategically in capabilities that in turn shaped both the choice of legislative policies as well as their implementation (*e.g.*, Cates 1983, Rosen 1988, Kato 1994, Carpenter 2001, Chisholm 2001).[2] While existing accounts of endogenous capacity generation are largely informal, their strategic intuition is clear enough. In an environment where capacity can affect outcomes that matter to politicians, bureaucrats *should* invest in it to constrain those outcomes in preferred ways.

More specifically, this account suggests that organizational capacity confers upon the agency a technological advantage over the principal, such as a legislature or executive. If this advantage is not easily appropriated by the principal, then the agency can use it to gain a measure of agenda

[1]The contrasting view is that the sources of capacity are external to the agency. High capacity may result from low corruption, or high quality civil service or judicial systems (*e.g.*, Besley and McLaren 1993, Geddes 1994, Evans and Rauch 1999, Rauch 2001). An agency's pre-existing resources, such as assets or personnel, can also play an important role. Finally, elected politicians may systematically under-value capacity, and therefore provide suboptimally for it (Derthick 1990). As Derthick argues, "The assumption that pervades policymaking is that the agency will be able to do what is asked of it because by law and constitutional tradition it *must*. It does not occur to presidential and congressional participants that the law should be tailored to the limits of organizational capacity" (1990: 184).

[2]Cates provides an excellent example of this strategy in his analysis of social security. Early program managers had so monopolized crucial implementation information that legislators had difficulty assessing alternatives to the agency's proposals, leading Senator Eugene Millikin (R-Col.) to complain in 1950 that "[t]he cold fact of the matter is that the basic information is alone in possession of the Social Security Agency. There is no private actuary . . . that can give you the complete picture . . . . I know what I am talking about because I tried to get that."

power.[3] This is done by investing in certain capabilities that affect the level of implementation of various policies, for example the number of clients served, or the number of errors avoided. The ability to make such investments may arise through purchasing or hiring authority, internal research departments, or explicit delegation. These allow the agency to determine up front the kinds of expertise, personnel, and data that can be brought to bear on specific policies. A principal who cared about implementation would then take these levels into account in her subsequent policy choices. Thus even in the absence of formal legislative powers, capacity can allow an agency to shape policy.

This paper develops this account further with a simple and tractable model of capacity. Its approach borrows from an extensive literature that addresses related problems in the theory of the firm (Grossman and Hart 1986, Hart and Moore 1988). It starts from the assumption that legislation is an "incomplete contract" for controlling the bureaucracy. In many inter-organizational agreements, activities that affect actors' payoffs may be too complex to specify contractually *ex ante*. Analogously, legislation directing agencies to execute a policy may necessarily be incomplete, in the sense of leaving critical implementation details — how to serve clients, or how to avoid errors — unspecified. This feature is the source of the agency's agenda power, since a legislature that cared about the effect of capacity on implementation would wish to specify these details unilaterally if it could.

This framework requires that outcomes occur not only on a standard spatial policy dimension, but also on an implementation, or quality, dimension. Only the latter is affected by capacity. Thus, a legislative statute can specify a policy such as an enforcement level, or a scientific goal. But the bureaucracy has a short-term monopoly over the technology governing its implementation (that is, its investment in capacity is non-contractible). This formulation distinguishes between what a legislature can control fully (policy) and what it cannot (capacity) in an intuitive way. It also usefully separates capacity from policy, so that strict enforcement of a lax policy (which may require high capacity) and lax enforcement of strict one (which may not) are conceptually distinct.[4] In the existing formal work on organizational capacity, capacity directly affects a policy dimension (Huber and McCarty 2004, 2006, Lewis 2008). For example, a low-capacity tax agency might implement a 30% tax rate by actually collecting 10% or 50%. By contrast, in the policy environment adopted here

[3] The model may therefore best describe existing agencies that have had opportunities to cultivate external constituencies. Alternatively, it may apply best to "coping" or "procedural" agencies, for which actions are difficult to observe (Wilson 2000).

[4] One feature that is lost in this simplification is the occasional association between capacity and "expertise." The present model does not feature incomplete information.

a low-capacity agency might collect 30% from only some eligible taxpayers, while a high-capacity agency would collect 30% from all.

The model embeds capacity in a setting that incorporates many features common to models of bureaucratic politics, such as preference divergence, specialization, and delegation. In the basic game, a political principal (*e.g.*, a legislature, or an executive) and an agency both care about the location of a policy x in a unidimensional space. For any policy, both players' utilities are also increasing in an implementation level, z, which is determined by the agency's choice of two variables. The first is a capacity vector $\mathbf{c}$, which is a set of investments that are costly to the agency.[5] The second is a target policy y at which z is maximized. In choosing x, the principal may therefore face a trade-off between policies and implementation levels. As in standard incomplete contracting models, there are two periods. The investment $\mathbf{c}$ is non-contractible in the first period, but becomes contractible in the second. Thus the principal's observation of capacity in the first period allows her to "renegotiate," by specifying any investment up to but not exceeding $\mathbf{c}$ in the second.[6] Loosely speaking, in the first period the policy domain is relatively new or poorly understood, but in the second the principal understands its implementation details well enough to write them into law. Crucially, this also allows the principal to appropriate the agent's initial capacity investment. But the appropriation must then respect the set of *ex ante* policy-capacity combinations traced out by the agency's investments.

The principal's ability to appropriate the agency's efforts depends on the technology through which investments are translated into implementation. There are two variants of the game, which capture polar opposites in this technology. In the first, the agency cannot target its investment toward a specific policy (*i.e.*, y is irrelevant). This reflects a "generalist" policy domain where skills such as client service and information technology are fungible. An agency such as the Internal Revenue Service, for which many activities (such as audits and fraud investigations) do not depend heavily on policy (*e.g.*, tax rates), might fit in this category. In the second, capacity is at a minimum everywhere except at y. This "specialist" environment might require equipment or employees with particular kinds of expertise. This case would best describe a military organization or parts of the U.S. Department of Agriculture, whose personnel and material resources are not easily re-deployed for purposes other than those originally intended.

[5]Since implementation is costly for the agency, it is a "valence" dimension for the principal but not the agency. Huber and McCarty (2006) derive the result that a principal always prefers higher-capacity agencies, as is assumed here.

[6]The principal cannot exceed $\mathbf{c}$, as this would imply the ability to raise the agency's investments for any policy, including those that the agency may not have targeted.

The main predictions relate implementation levels, policy choice, and the technological environment. In the generalist case, the principal can always appropriate the agency's capacity investment for use on her ideal policy. The implementation level therefore decreases in the distance between the players' ideal policies. One way for the principal to encourage investment is to delegate policy-making authority to the agent, particularly when the players' preferences coincide. But these incentives are weakened by the principal's inability to commit to non-renegotiation from the agency's policy choice to her own ideal *ex post*.

Somewhat surprisingly, the specialist case can reverse these results. Here, the agent's targeted investment can force the principal to choose between a badly implemented ideal policy and a better implemented but more distant policy (y). Compared with the generalist case, the investment is less easily appropriated, and thus in equilibrium policies are closer to the agency's ideal and the implementation level is higher. Consequently, when the agency is "professional" in the sense of valuing implementation relatively independently of policy, capacity *increases* in the distance between ideal points. The implications for delegation are especially stark. In contrast with both the generalist case and much of the literature on delegation, the principal never delegates policy authority (*e.g.*, Gilligan and Krehbiel 1987, Epstein and O'Halloran 1994, Aghion and Tirole 1997, Huber and Shipan 2002, Gailmard 2002, 2009, Bendor and Meirowitz 2004).

Pushing the analysis a step further, the results imply that the agency unambiguously prefers to be a specialist, while the principal often prefers a generalist. These induced preferences might be reflected in the principal's design of agency personnel systems. In fact, the early civil service systems in France, the United Kingdom, and the United States all displayed a strong orientation toward cultivating "general" competence amongst public sector managers (Suleiman 1974, Silberman 1993).

The model joins a growing formal literature that addresses organizational capacity. Huber and McCarty (2004) also consider the implications of capacity for bureaucratic delegation, but in an environment where capacity is exogenously given and there is no "quality" dimension of output. In contrast with my model, theirs predicts that delegation should be associated with high-capacity agencies. Additionally, the recent works on personnel policy by Gailmard and Patty (2007) and Lewis (2008) represent initial steps toward endogenizing capacity. The former consider policy-specific investments by individual civil servants in a principal-agent framework.[7] The latter examines the president's trade-off between capacity and policy performance inherent in the choice between civil servants and political appointees. It also suggests ways in which hypotheses about

[7] Dixit (2002) provides a useful overview of this general issue.

capacity may be tested. Finally, Besley and Persson (n.d.) consider the more general question of state capacity. Their model investigates conditions under which a government will invest in costly legal and fiscal capacity early in order to maximize public goods later.

Theoretically, the game bears a family resemblance to models of incomplete contracts (Tirole 1999), which typically examine the contracting relationship between two firms in a joint production environment. As in the model developed here, one party can make a non-contractible investment that is potentially valuable to the relationship.[8] There are several noticeable differences, however. They usually give the investor some bargaining power in renegotiation, and do not feature a spatial outcome dimension. Within this body of work, the present model is perhaps most closely related to that of Bernheim and Whinston (1998), who study delegation in a principal-agent relationship, and Besley and Ghatak (2001), who address public- and private-sector ownership with non-contractible investments and public goods.

The paper proceeds as follows. The next section sets up the basic model, and the results are presented in Section 3. Section 4 considers the question of delegation under the framework. Section 5 discusses the results and concludes.

2. The Model

The model is a game of policy-making with endogenous organizational capacity over two periods. There are two players, P and A, corresponding to a principal and an agent. Except where otherwise noted, time periods are denoted with subscripts and players with superscripts.

Each player cares about policy and the implementation level thereof. A policy is some $x \in X$, where $X \subset \Re$ is compact and convex. For each policy, the implementation level z is determined by a production function, or *capacity function* $z : X \times X \times \Re^m_+ \to \Re_+$. The first two arguments of $z(x, y, \mathbf{c})$ are the chosen policy and a *target policy*, respectively. The relationship between the two is critical and will be specified in later sections. The last argument is the capacity vector, which consists of $m \geq 1$ (finite) investments. This vector represents the possibility that a policy's implementation level can be the result of multiple (and possibly independent) costly inputs, such as personnel, research, or demonstration projects. The capacity function is weakly concave and increasing in each investment c_j. Further, $\frac{\partial^2 z}{\partial c_i \partial c_j} \geq 0$ for $i \neq j$, so that investments may be complementary. Without any investment, the default implementation level for any x_t and y is $z(x_t, y, \mathbf{0}) = 0$. The capacity investment imposes a cost $k(\mathbf{c})$ on A, where $k : \Re^m_+ \to \Re_+$ is continuous, increasing, and

[8] Using different frameworks, Prendergast (2003) and Prendergast and Stole (1996) also consider environments where employee investments can improve organizational outputs.

convex. I assume that $\frac{\partial^2 k}{\partial c_i \partial c_j} \leq 0$ for $i \neq j$, to allow for possible cost efficiencies across investments.

For player i, utility over policy and implementation is given by $u^i(x, z(\cdot); x^i)$, where $u^i : X \times \Re_+ \times X \to \Re$ is C^2 and concave in x. At any implementation level, i's ideal policy is $x^i \in X$. For A, I further assume that $u^A(x, z(\cdot); x^A) = u(|x - x^A|, z(\cdot))$, so that the "shape" of A's utility function is independent of x^A. Without loss of generality, let $x^P < x^A$. It will often be convenient to suppress the dependency of $u^i(\cdot)$ on x^i.

Of particular interest in this model is the effect of a policy's implementation level on each player's utility. Each player prefers higher implementation levels but also has diminishing marginal valuation of implementation: $\frac{\partial u^i}{\partial z} > 0$ and $\frac{\partial^2 u^i}{\partial z^2} \leq 0$ at any policy x. Each player i's marginal utility from implementation is also increasing in the proximity of x to x^i: $\frac{\partial^2 u^i}{\partial z \partial x} > (=)(<)\ 0$ for $x < (=)(>)\ x^i$. It will be furthermore be useful to impose some structure A's cross-partial: $\frac{\partial^2 u^A}{\partial z \partial x}(x, z) = p\pi(x)$ for $x < x^A$, where $p \in \Re_+$ and $\pi : \Re_+ \to \Re_+$ is continuous, bounded and strictly decreasing. The parameter p might correspond to the agent's level of "politicization." When p is low, the agent's utility over implementation is relatively independent of the policy. This corresponds to the notion of a "neutrally competent" bureaucracy (*e.g.*, Fesler 1980). By contrast, an agent with a high p wants a lower level of implementation if policy is located far from x^A.

The period t utility functions for P and A, respectively, can be written as:

$$U_t^P(x_t, y, \mathbf{c}_t) \quad = \quad u^P(x_t, z(x_t, y, \mathbf{c}_t); x^P) \tag{1}$$

$$U_t^A(x_t, y, \mathbf{c}_t) \quad = \quad u^A(x_t, z(x_t, y, \mathbf{c}_t); x^A) - k(\mathbf{c}_t). \tag{2}$$

Player i's total utility is given by $U_1^i(\cdot) + \delta^i U_2^i(\cdot)$, where $\delta^P, \delta^A \geq 0$. This allows the second period to represent either a discounted second period of interaction, or the reduced form for a stream of future interactions.

To avoid a number of uninteresting cases, several minor technical assumptions are made. First, to avoid corner solutions I adopt some standard Inada-type conditions: $\frac{\partial k}{\partial c_j}(\mathbf{0}) = 0$ and $\lim_{c_j \to \infty} \frac{\partial z}{\partial c_j} = 0$ for all inputs j, and $\lim_{z \to \infty} \frac{\partial u^i}{\partial z} = 0$ for all players i. Second, there exists some z satisfying $u^P(x^P, 0) = u^P(x, z)$ for all x, so that P can be made indifferent between her ideal policy with an implementation level of zero and any feasible policy with a sufficiently high implementation level.[9] Finally, $\frac{\partial^2 u^A}{\partial x^2}$ is bounded away from zero.

Players in the game are completely and perfectly informed. The sequence of the game is as follows.

[9]This assumption is equivalent to saying that implementation is important to P in the policy area in question. If the assumption were violated, then P would not be willing to trade policy for implementation over some range of X.

1. (*Period One*) A chooses its capacity investment, $\mathbf{c}_1 \in \Re^m_+$ and a target policy $y \in X$.

2. P chooses policy $x_1 \in X$.

3. (*Period Two*) P chooses policy $x_2 \in X$, and A's capacity investment, $\mathbf{c}_2 \in \{\mathbf{c} \mid \mathbf{0} \leq \mathbf{c} \leq \mathbf{c}_1\}$.

Two assumptions about the sequence are worth noting here. First, the assumption that capacity investment precedes policy choice might represent an agency's preparation for an upcoming policy debate. As intuition might suggest, this is a source of A's agenda power, although as Section 3 discusses some of the results do not depend on this particular ordering. An alternative formulation that would give A more power would be to make feasible policy choices in X depend on $\mathbf{c}_1$.[10] Second, the assumption that policy is initiated by the principal might correspond to a policy arena in which P writes legislation that assigns responsibility to A. However, A might choose x_1 if it has authority either pre-existing from previous legislation or explicitly delegated by P. This possibility is addressed in Section 4.

The sequence also makes clear the game's incomplete contracting structure. *Ex ante*, in the initial legislation or rule over X, P cannot specify anything about A's capacity investment.[11] However, the revelation of A's first period action renders the investment contractible *ex post*. P might, for example, learn of an appropriate monitoring technology that allows her to impose A's period 2 capacity investment up to $\mathbf{c}_1$. She can also re-adjust the policy. These steps are analogous to renegotiation in incomplete contracting relationships. However, the target y is never contractible: it is "sunk" and cannot be modified.

I characterize subgame perfect equilibria in pure strategies. A's strategy $s^A \in \Re^m_+ \times X$ specifies her period 1 capacity investment and targeted policy. P's strategy $s^P : \Re^m_+ \times X \rightarrow X^2 \times \{\mathbf{c} \mid \mathbf{0} \leq \mathbf{c} \leq \mathbf{c}_1\}$ maps the capacity investment and target policy to period 1 and 2 polices and period 2 capacity investment. It will be notationally convenient to identify directly the components of the equilibrium values of s^A and s^P. Thus, let y^* denote the equilibrium target policy, and let x^*_t, $\mathbf{c}^*_t$, and z^*_t denote the equilibrium period t policy, capacity investment, and implementation level, respectively. I make two tie-breaking assumptions. First, when re-setting the capacity investment, P breaks ties in favor of lower levels of investment. While the investment is modeled as being

[10] For example, the acquisition of a particular kind of surveillance device by the military might facilitate its involvement in certain kinds of law enforcement activities.

[11] Note also that P cannot constrain A's ability to choose $\mathbf{c}_1$. The implicit assumption is that enough "slack" exists to permit the agent's initial investment. It is possible, however, that P could control A's budget constraint. Allowing this would increase P's ability to reduce undesirable over-investment by A.

costless to P, this captures in a simple way the fact that P ultimately must "pay" for all of A's resources. Second, A chooses the target policy closest to x^A.

3. Main Results

There are two variants of the basic game, which differ only in the form of the capacity function. In the *general capacity* (GC) game, $z(\cdot)$ is independent of x_t and y, and so any investment generates the same implementation level across all policies. In the *specialized capacity* (SC) game, the investment applies only toward policy y. The two variants therefore capture opposite extremes in the agent's ability to discriminate in its capacity investment, as well as in her bargaining power.

For both models, it will be useful to define first A's most preferred investment vector. A's utility function implies the existence of a unique optimal investment vector for any policy x and ideal point x^A. This vector will be used frequently in what follows, and is denoted:

$$\mathbf{c}^\circ(x; x^A) \equiv \arg\max_{\mathbf{c}} u^A(x, z(x, x, \mathbf{c}); x^A) - k(\mathbf{c}). \tag{3}$$

For convenience, when the ideal point is understood, $\mathbf{c}^\circ(x; x^A)$ will be abbreviated $\mathbf{c}^\circ(x)$, and if $x = x^A$, simply $\mathbf{c}^\circ$ will be used. Clearly, $\mathbf{c}^\circ(x)$ is component-wise weakly decreasing in $|x - x^A|$.[12]

3.1 General Capacity

Consider first the game in which the capacity function is of the form:

$$z(x_t, y, \mathbf{c}_t) = \tilde{z}(\mathbf{c}_t). \tag{4}$$

It will therefore be convenient to eliminate references to y in the remainder of this subsection. Since the implementation level is independent of both policy and the target of A's capacity investment, P can appropriate this investment for any purpose. However, P may be hurt by A's anticipation of this strategy.

The subgame perfect equilibrium strategies can be derived very simply by inducting backward from the second period. In period 2, P can revise policy to her liking, as well as specify A's investment up to $\mathbf{c}_1$, the level previously provided by A. Her objective in period 2 is given by (1). For any implementation level, x^P is her optimal policy. Since $\frac{\partial u^P}{\partial z} > 0$, P also wishes to maximize z, which implies a capacity investment of $\mathbf{c}_1$. Therefore, $x_2^* = x^P$ and $\mathbf{c}_2^* = \mathbf{c}_1$.[13]

[12] Calvert, McCubbins, and Weingast (1989) use a similar, but more specific utility function in a model of agency discretion and budgeting.

[13] If, contrary to the assumptions of the model, $\frac{\partial u^P}{\partial z} < 0$, then it is possible that P would wish to renegotiate to a lower level of $\mathbf{c}_2^*$.

Because actions in period 1 do not affect period 2 choices, by (1), P's best response to any $\mathbf{c}_1$ is her ideal policy, and thus $x_1^* = x^P$. A then chooses $\mathbf{c}_1$ to maximize:

$$V(\mathbf{c}_1; x^A) = (1+\delta^A)\left[u^A(x^P, \tilde{z}(\mathbf{c}_1); x^A) - k(\mathbf{c}_1)\right]. \tag{5}$$

This objective is clearly concave in $\mathbf{c}_1$, and the assumptions made on $u^A(\cdot)$ and $k(\cdot)$ ensure that any solutions are interior. Observe that (5) is essentially the same objective function as (3), and thus the second period has no effect on A's strategy. The solution $\mathbf{c}_1^* = \mathbf{c}^\circ(x^P)$ is therefore unique and characterized by first-order conditions. This implies that the general capacity game has a unique subgame perfect equilibrium. The first result, on policy choices, follows directly and is stated without proof.

Proposition 1 Policy under general capacity. *The GC game has a unique subgame perfect equilibrium, where $x_1^* = x_2^* = x^P$.* ■

Combined with non-targetable policy technology, the ability to set policy at x^P in both periods allows P to capture the entire benefit of A's investment. This gives the agent less incentive to invest in capacity when her preferences do not coincide with P's. As the following result establishes, the equilibrium implementation level is decreasing in x^A (*i.e.*, as x^A diverges from x^P).[14]

Proposition 2 Capacity and implementation under general capacity. *In the subgame perfect equilibrium of the GC game:*

(i) $\mathbf{c}_1^* = \mathbf{c}_2^* = \mathbf{c}^\circ(x^P)$.

(ii) $\mathbf{c}_1^*$ *and* z_1^* *are strictly decreasing in* x^A. ■

Proof All proofs are in the Appendix. ■

This result suggests that when capacity investments are fungible, high implementation levels require agreement on the policy dimension. The comparative statics echo those of many models of delegation, whereby ideologically close players are more inclined to reveal information or undertake costly effort. General capacity therefore removes any advantage that an agency might gain from being able to move first into a new policy arena.

3.2 Specialized Capacity

[14]The technique of the proof can also be used to show that $\mathbf{c}_1^*$ is increasing in $u^A(x^P)$.

In this variant of the game, capacity may be targeted completely toward one policy. Formally, the capacity function takes the following form:

$$z(x_t, y, \mathbf{c}_t) = \begin{cases} \tilde{z}(\mathbf{c}_t) & \text{if } x_t = y \\ 0 & \text{otherwise.} \end{cases} \tag{6}$$

where $\tilde{z}(\mathbf{c}_t)$ is as in the SC game. An immediate implication is that the agent may now be able to force the principal to trade off between inferior implementation of a "good" policy, or superior implementation of a "bad" policy. This increase in the agent's bargaining power will shift not only policy choices and capacity and implementation levels, but also some of their associated comparative statics.

Inducting backwards, in period 2, P can adopt either of two strategies. First, if she chooses any $x_2 \neq y$, then the optimal policy is clearly x^P (if $x^P \neq y$). This implies that she will reset the capacity investment to $\mathbf{c}_2 = \mathbf{0}$, resulting in $z(x_2, y, \mathbf{0}) = 0$. Second, if she chooses $x_2 = y$, then she maximizes z_2, and hence $\mathbf{c}_2 = \mathbf{c}_1$. P therefore chooses $x_2 = y$ if:

$$u^P(x^P, 0) \leq u^P(y, \tilde{z}(\mathbf{c}_1)). \tag{7}$$

In period 1, P's policy calculation is identical, and thus she chooses $x_1 = y$ if (7) holds. Thus across periods, P accepts policy $y \neq x^P$ if she is "compensated" with an implementation level sufficient to satisfy (7). To make this idea concrete, let $\gamma : X \rightarrow \Re_+$ denote the implementation level z that satisfies (7) with equality. In other words, $\gamma(y)$ gives the value of z such that $u^P(x^P, 0) = u^P(y, z)$. It is obvious that $\gamma(x^P) = 0$. As y moves away from x^P, satisfying (7) requires a higher marginal increases in capacity, and thus $\gamma(y)$ is increasing and convex for $y \geq x^P$.

While an implementation level of $\gamma(y)$ would cause P to choose y over x^P, it remains to be determined whether A's strategy will induce this response. To see whether A can find a suitable y to invest in, it will be helpful to begin by considering her optimal investment choices for each policy. Note that $\tilde{z}(\mathbf{c}^\circ(y; x^A))$ is the (unique) implementation level that A would optimally provide for a policy located at y, absent the constraint of renegotiation. It is easily verified that $\tilde{z}(\mathbf{c}^\circ(y; x^A))$ is decreasing in the distance between y and x^A and strictly positive. The implementation level is therefore minimized on $[x^P, x^A]$ at x^P, where the associated implementation level $\tilde{z}(\mathbf{c}^\circ(x^P))$ is identical to that in the GC game.

The functions $\gamma(y)$ and $\tilde{z}(\mathbf{c}^\circ(y; x^A))$ can be compared to characterize the capacity investment and hence implementation levels that A would provide for any given y. If $\tilde{z}(\mathbf{c}^\circ(y; x^A)) \geq \gamma(y)$, then A is willing to invest in more than the minimum capacity necessary for P not to ignore the investment in y. Otherwise, A must produce at least $\gamma(y)$ (and clearly does not wish to produce more). Hence if $x_t = y$ then the equilibrium implementation level z_t^* must satisfy:

$$z_t^* = \max\{\gamma(y), \tilde{z}(\mathbf{c}^\circ(y; x^A))\} \text{ for some } y. \tag{8}$$

The next result uses this fact to establish the range of possible equilibrium policies. Intuitively, the proposition rules out the possibility that P could deviate from y and choose x^P (with zero capacity), because A would strictly prefer to invest optimally in x^P by providing implementation level $\tilde{z}(\mathbf{c}^\circ(x^P))$ to that outcome. However, there always exists a policy closer to x^A that would allow A to do even better.

Proposition 3 Policy under specialized capacity. *In the SC game,* $x_1^* = x_2^* = y^*$ *and* $y^* \in (x^P, x^A]$.
■

Along with (8), Proposition 3 greatly simplifies the derivation of the key features of organizational capacity and implementation levels. In equilibrium, P adopts A's targeted policy at y^*. It follows immediately that P also does not alter the first period capacity investments. A's investment strategy therefore completely prevents P from renegotiating its first period choices.

The solution for y^* depends on whether A can optimally invest in her ideal policy x^A without renegotiation. To see whether this is possible, it is helpful to define the policy x_c, at which $\gamma(\cdot)$ equals A's ideal implementation at her ideal policy, $z(\mathbf{c}^\circ)$:

$$\gamma(x_c) = \tilde{z}(\mathbf{c}^\circ). \tag{9}$$

Since $\gamma(\cdot)$ is strictly increasing, x_c is uniquely defined. As illustrated in Figure 1, its location generates two cases. First, if $x^A \leq x_c$, then clearly $\tilde{z}(\mathbf{c}^\circ) \geq \gamma(x^A)$. A can then make her most preferred capacity investment in her ideal policy and leave P better off than a policy at x^P and a zero implementation level.

Second, if $x^A > x_c$, then $\tilde{z}(\mathbf{c}^\circ) < \gamma(x^A)$ and A cannot invest optimally in x^A. Securing x^A would require over-investment in capacity, and A might instead prefer to compromise on policy to reduce her investment costs. A crucial fact of this case is that for the schedule of target policies and implementation levels implied by y and $\tilde{z}(\mathbf{c}^\circ(y; x^A))$, A prefers policies and implementation levels closer to x^A. In other words, $U_t^A(\cdot)$ is strictly increasing in $y \in (x^P, x^A]$ along $\tilde{z}(\cdot)$. Let $y_c \equiv \max\{y \mid \gamma(y) = \tilde{z}(\mathbf{c}^\circ(y; x^A))\}$ denote the policy closest to x^A such that $\gamma(\cdot)$ and $\tilde{z}(\cdot)$ intersect.[15]

[15]The existence of this point follows from the facts that $\gamma(x^P) = 0$ and $\tilde{z}(\mathbf{c}^\circ(x^P; x^A)) > 0$.

Then by the definition of $\tilde{z}(\cdot)$, A must prefer the combination of y_c and $\tilde{z}(\mathbf{c}^{\circ}(y_c; x^A))$ to any target policy $y < y_c$ at *any* associated implementation level. Thus the solution satisfies $y^* \in [y_c, x^A]$ and—by (8)—the equilibrium implementation level must be $\gamma(y^*)$.

[Figure 1 here.]

To produce any $\gamma(y)$, A wishes to choose the lowest-cost investment vector, which is given by:

$$\underline{\mathbf{c}}(y) = \arg\min_{\{\mathbf{c}|\tilde{z}(\mathbf{c})=\gamma(y)\}} k(\mathbf{c}). \tag{10}$$

By the concavity of $\tilde{z}(\cdot)$ and convexity of $k(\cdot)$, $\underline{\mathbf{c}}(y)$ is single-valued. Along with the previous argument, this expression allows A's objective to be re-written in terms of y:

$$V(y; x^A) = (1 + \delta^A) \left[u^A(y, \gamma(y)) - k(\underline{\mathbf{c}}(y)) \right]. \tag{11}$$

The quasi-concavity of (11) is not guaranteed, and so the uniqueness of subgame perfect equilibria may depend on functional forms.[16]

Since $\gamma(y)$ is increasing, the comparative statics on implementation levels for this case are the same as those for the choice variable, y. The next result uses this fact to derive the key properties of capacity and implementation levels in the SC game. Specialized capacity raises implementation levels and can reverse the negative relationship with preference divergence found in the GC game.

Proposition 4 Capacity and implementation under specialized capacity. *In the SC game:*

(i) $\mathbf{c}_1^* = \mathbf{c}_2^* \geq \mathbf{c}^{\circ}(x^P)$*, and* z_1^* *is strictly higher than in the GC game.*

(ii) z_1^* *is weakly increasing in* x^A *for* $x^A < x_c + \epsilon$ *for some* $\epsilon > 0$.

(iii) There exists $\underline{p} > 0$ *such that if* $p < \underline{p}$*, then* z_1^* *is strictly increasing in* x^A *for* $x^A > x_c$.[17]

■

A comparison of Propositions 1-4 reveals the main intuitions behind the effects of specialization on policy and implementation. In contrast with the GC game, P compromises on policy in the SC game. For a "friendly" agent with ideal point close to x^P, (specifically, $x^A \in [x^P, x_c]$), equilibrium policy is located at x^A. For less friendly agents, policy is located in $(x^P, x^A]$. Specialized investment therefore effectively commits P not to unravel A's investment. A's targeted policy then becomes at

[16] Where there is non-uniqueness, it is assumed that when indifferent, A chooses y^* closest to x^A. This assumption does not affect any of the results of this section.

[17] A result for weak monotonicity alone can be obtained more simply by applying the Monotone Selection Theorem of Milgrom and Shannon (1994).

least as attractive as x^P. Thus, while the basic general and specialized capacity games both predict no renegotiation, the reasons are quite different: in one, A is powerless to affect P's behavior, but in the other, A can make renegotiation prohibitively costly to P.

A's advantage in the SC game follows from P's limited renegotiation abilities. Increasing the contractability of A's choice variables could of course result either in more defensive investments in period 1, or renegotiation in period 2. A also benefits from moving first, unlike in the GC game. It is worth noting that if P could choose a policy before allowing A to choose how much to invest, then P could neutralize A's ability to target her investment. P's selection of x_1 would induce A to invest optimally in it, yielding implementation level $\tilde{z}(\mathbf{c}^\circ(x_1; x^A))$. P could thereby guarantee herself an outcome at least as good as when A moved first. In equilibrium, P would still need to compromise on policy, but the chosen policy will be (weakly) closer to x^P.

The effects of policy preferences on implementation contrast sharply across the games. Because P does not renegotiate policy and cannot re-target A's investment, A invests more in capacity and implementation levels are higher under specialized capacity. If A is "friendly" ($x^A \in [x^P, x_c]$), then she targets x^A and invests her optimal amount, $\mathbf{c}^\circ$, in it. As x^A increases beyond x_c, A must "overpay" and provide a higher implementation level, $\gamma(y^*)$, to secure a policy close to her ideal. Thus under specialized capacity, the comparative statics result of Proposition 2 cannot hold: implementation levels are not decreasing in x^A.

For even higher values of x^A, the effect on implementation depends on the politicization level p, which measures the change in the agent's marginal utility from capacity with respect to policy (or her ideal point). If p is sufficiently low, then A's desire for implementation is relatively independent of policy. For such an "apolitical" or "neutrally competent" agent, implementation strictly increases with the divergence of preferences between actors. This is because A receives relatively high marginal utility from implementation even when chosen policies are distant from x^A. But policy does not necessarily monotonically increase in x^A. If p and x^A are sufficiently high, then at the margin A might prefer to shift policy *away* from x^A in order to reduce the implementation level needed to satisfy P.

3.3 Numerical Example

To illustrate the comparative statics of the specialized capacity game, suppose that there are two capacity investments, c_1 and c_2. These cost the agent $k(\mathbf{c}) = c_1^2 + c_2^2$ and yield an implementation level $z = c_1 + c_2$. The policy space is $X = [0, 16]$.

Each player i has additive utility, receiving $-(x - x^i)^2$ from the policy choice x in a given period.

P's ideal policy is $x^P = 0$, while A's ideal x^A will vary. P receives z from implementation, and A receives $[75 - (x - x^i)^2 p]z$ from implementation. P's utility function implies that she requires an implementation level of $\gamma(y) = y^2$ to make her indifferent between a policy at y and her ideal policy and a zero implementation level. A's utility function implies that there may be "corner" solutions where her ideal implementation level is zero when p is high, but such cases are not considered here. These functions instantiate in a simple way the idea that implementation (and hence capacity investments) is more valuable to A for more desirable policies.

Even under these simple functional form assumptions, closed-form solutions for y^* are cumbersome to derive. Figure 2 plots numerical results for equilibrium implementation across x^A and for three values of politicization, p.

[Figure 2 here.]

As predicted by the discussion of the previous subsection, there are three areas of interest as x^A increases. First, below x_c (≈ 8.66) implementation is constant and equal to $\tilde{z}(\mathbf{c}^{\circ})$. That is, A is able to invest optimally in her ideal policy because P has relatively modest capacity demands. Second, above and "close" to x_c, implementation is strictly increasing in x^A. This reflects A's need to over-invest in policies in order for P to find them acceptable. Third, farther away from x_c, implementation remains strictly increasing in x^A only for low values of p. When A is an "extremist," a politicized agent finds capacity investments so costly that she would prefer instead to compromise on policy. Note that above x_c, the comparative statics on y^* as a function of x^A are identical in sign to those on implementation, since the implementation level is given by $\gamma(y)$, which is increasing in y.

The results for higher values of p in the figure suggest that implementation is monotonically decreasing for x^A sufficiently high. In fact, a stronger result can be obtained by extending the proof of Proposition 4: if $\frac{\partial^3 u^A}{\partial x^3} \leq 0$ and implementation (or policy) is decreasing at any $x^{A'}$, then it must also be decreasing for all $x^A > x^{A'}$. This result therefore applies to a large class of utility functions (including those with positive exponents no higher than 2). However, the result is not true in general.

3.4 Endogenous Specialization

The preceding discussion raises the question of what kind of capacity technology players would prefer. In practice, it is likely that the policy domain constrains the technology somewhat. Driver license agencies are inevitably generalists, while law enforcement or scientific research agencies will be more specialized.[18] In some environments, however, it is possible that the capacity technology can be a choice of one of the players. For example, the practices of rotating bureaucrats through field offices and enforcing broad educational backgrounds may encourage generalism.

To determine the incentives to specialize, I simply compare utility levels across the GC and SC games. The result is that the agent will unambiguously benefit from specialization, while the principal will not benefit if their ideal points are distant. Specialization ensures that the agent's investment will not be appropriated. But since specialization may result in capacity $\gamma(y^*)$ if $|x^P - x^A|$ is sufficiently large, the principal is left indifferent between a policy at x^P and zero capacity. This outcome is strictly worse than that under the general capacity game.

Proposition 5 Preferences over specialization. *For all* t*,*

(i) $U_t^A(x_t^*, y^*, \mathbf{c}_t^*)$ *is strictly higher under specialized capacity than under general capacity.*

(ii) $U_t^P(x_t^*, y^*, \mathbf{c}_t^*)$ *is strictly lower under specialized capacity than under general capacity for* $x^A \geq x_c$*.* ■

Observe that since the function $\tilde{z}(\cdot)$ is identical across games, this approach may underestimate the benefits of specialization if a specialized agent could generate higher implementation levels at y than a generalist. Nevertheless, Proposition 5 implies that an agent will, where possible, define her area of expertise or competence narrowly. A lack of specialization leaves the agent vulnerable to less desirable policies. Expanding the scope of the model a bit, this result also suggests a possible rationale for why that agency leaders will sometimes shun new responsibilities or "turf." While the addition of new areas of competence may improve a bureaucrat's budget or career prospects, her utility may also suffer if the principal subsequently orders the bureaucrat to perform less-favored tasks.

The principal, on the other hand, values the ability to appropriate A's capacity investments when her ideal point is distant. The result does not necessarily hold when ideal points are closer. In this case, P may prefer specialization *ex ante* because increased capacity may outweigh the (smaller) loss from moving policy away from x^P.

There is some evidence that principals have historically preferred generalist agencies. Immediately following World War II, French leaders implemented a uniform, government-wide *concours* exam and re-established the Ecole Nationale d'Administration. The purpose of these reforms was to create a class of more broadly-trained senior administrators who would be less loyal to particular

[18] See for example Wilson's (2000) discussion of the difficulties encountered by the Department of Agriculture in running the Food Stamp program, or the Federal Bureau of Investigation in performing narcotics investigations.

agencies and more easily re-assigned within the bureaucracy (Suleiman 1974). By contrast, the designers of the British civil service did not have the benefit of a national academy. However, as laid out by the Northcote-Trevelyan report of 1853-54, this system also deliberately cultivated "generalists" through the examinations and greater state control of Oxford and Cambridge universities (Silberman 1993). Finally, prior to the Classification Act of 1923, personnel rotations were routine in many American agencies. While these practices aided the distribution of patronage, they also minimized the political independence of the bureaucracy (Silberman 1993).[19]

4. Delegation

A substantial literature has examined the question of when agent initiative is intentionally given by principals. The endogenous development of capacity has several implications for the delegation of authority to bureaucratic agencies. The discussion here proceeds in two steps; the first gives A the ability to choose policy, while the second endogenizes P's choice of policy-making rights. Note that because the capacity investment becomes contractible in period 2, P has no incentive to delegate in period 2, and so I only consider the questions of agent-initiated policy and delegation in period 1.

4.1 Agent-Initiated Policy

In many situations, the agent may set policy instead of the principal. A political agency may have pre-existing authority to set policy unilaterally, or it might be in a "subgame" where the principal has explicitly delegated authority. This subsection considers the consequences of agent-initiated policy.

The sequence of the game remains unchanged, with the exception that the period 1 policy choice shifts from P to A. Thus, A's strategy $s^A \in \Re^m_+ \times X \times X$ specifies her period 1 capacity investment, targeted policy, and period 1 policy choice. P's strategy $s^P : \Re^m_+ \times X \times X \to X \times \{\mathbf{c} \mid \mathbf{0} \leq \mathbf{c} \leq \mathbf{c}_1\}$ maps the period 1 history into a choice of period 2 capacity investment and policy. This change clearly gives A more power, and consequently raises the possibility of equilibrium renegotiation. To avoid confusion about notation when comparing against the previous games, parameters in the agent-initiated model are denoted with a "^" where applicable.

General capacity. In the GC game, the players' period 2 strategies remain unchanged from the principal-initiated game. P chooses her ideal policy in period 2, and maximizes capacity; thus,

[19] As Kaufman (1960) relates in his analysis of the early U.S. Forest Service, managers *within* an agency also used regular personnel rotations to maintain cadres of generalists. In the U.S. Department of Agriculture, the predominance of generalists was broken in part by cultivating recruitment networks in land-grant colleges (Carpenter 2001).

$\hat{x}_2^* = x^P$ and $\hat{\mathbf{c}}_2^* = \mathbf{c}_1$. In period 1, A chooses x_1 along with $\mathbf{c}_1$. For any implementation level, A's optimal policy response is her ideal policy, and hence $\hat{x}_1^* = x^A$. She anticipates, however, that $\mathbf{c}_1$ will be appropriated for use on policy x^P in period 2. A's induced objective is then:

$$\hat{V}(\mathbf{c}_1; x^A) = u^A(x^A, \tilde{z}(\mathbf{c}_1)) - k(\mathbf{c}_1) + \delta^A \left[u^A(x^P, \tilde{z}(\mathbf{c}_1)) - k(\mathbf{c}_1) \right]. \tag{12}$$

Like A's objective in the GC game (5), $\hat{V}(\cdot)$ is concave, and thus the subgame perfect equilibrium is unique.

The first result uses (12) to derive properties of equilibrium capacity investments, and is analogous to Proposition 2. As in the principal-initiated game, P's ability to capture much of the benefit of A's investment results in capacity and implementation levels decreasing with x^A (*i.e.*, as x^A diverges from x^P). However, capacity and implementation levels are higher in the agent-initiated game, especially if A does not value future payoffs too highly. This is because A can at least realize her ideal policy in period 1, which induces her to invest more.[20]

Proposition 6 Capacity under general capacity and agent-initiated policy. *In the subgame perfect equilibrium of the GC game:*

(i) $\hat{\mathbf{c}}_1^* = \hat{\mathbf{c}}_2^*$.

(ii) $\hat{\mathbf{c}}_1^*$ *and* $\hat{z}_1^*$ *are strictly decreasing in* x^A.

(iii) $\hat{\mathbf{c}}_1^* > \mathbf{c}_1^*$ *and* $\hat{z}_1^* > z_1^*$. ∎

Part (ii) of Proposition 6 can also be extended to show that under some general conditions, capacity is decreasing in δ^A as well. Thus in addition to similarity in preferences, high organizational capacity and high levels of policy implementation under general capacity might occur when a short-lived (*i.e.*, low δ^A) agent initially chooses policy. The result is counter-intuitive because it suggests that common "insulating" features of bureaucratic working environments, such as job tenure, can have a *negative* impact on capacity investment. This occurs because of renegotiation, as the principal's ability to overturn a policy and contract on its underlying implementation technology would work against a long-term agent's investment incentives. By contrast, a short-term agent would worry less about principal's future ability to appropriate her investment.[21] The agent's

[20]The technique of the proof can also be used easily to show that at an interior solution, $\hat{\mathbf{c}}_1^*$ is increasing in $u^A(x^P)$ and in $u^A(x^A)$.

[21]Note that this prediction requires that short-term agents in fact discount heavily. If, for example, political appointees cared about the actions of their successors, then the principal's appropriation will weigh more heavily on their investments.

ability to set policy is critical to this result, as $\hat{\mathbf{c}}_1^*$ is independent of δ^A when the principal chooses x_1.

Specialized capacity. In the SC game, the target policy y affects P's choice of x_2 in a manner identical to that of the SC game with principal-initiated policy. In period 1, however, the possibility of disassociating policy from investment gives A three classes of strategies. First, as before A can match her policy choice with y. In this case, her objective is given by (11), and the results are identical to those in the analogous principal-initiated game.

However, A's incentives may change in two ways. She could instead choose $x_1 \neq y$. In this class of strategies, the optimal policy is x^A. Thus A can secure x^A in period 1 with capacity $\mathbf{0}$, as well as a policy ($x_2 = y$) more favorable than x^P in period 2. A therefore pays twice for a capacity investment that is realized only in period 2. To characterize this investment, A must also take into account the minimum investment $\underline{\mathbf{c}}(y)$ (given by (10)) that would produce implementation level $\gamma(y)$. Investing any less would be ineffective, as it would not induce P to choose policy y in period 2. A therefore solves:

$$\hat{\mathbf{c}}^\circ(y; x^A) = \max\left\{\underline{\mathbf{c}}(y), \arg\max_{\mathbf{c}} u^A(x^A, 0) + \delta^A u^A(y, \tilde{z}(\mathbf{c})) - (1+\delta^A)k(\mathbf{c})\right\}. \tag{13}$$

Because of the higher marginal cost of producing implemented policy, for any given y A invests no more under this strategy than in the principal-initiated game. A's objective under this class of strategies is then:

$$u^A(x^A, 0) + \delta^A u^A(y, \tilde{z}(\hat{\mathbf{c}}^\circ(y; x^A))) - (1+\delta^A)k(\hat{\mathbf{c}}^\circ(y; x^A)). \tag{14}$$

Finally, A might target and choose some policy x_1 even if she anticipates that P will overturn it later by choosing $x_2 = x^P$ and $\mathbf{c}_2 = \mathbf{0}$. In this class of strategies, A's optimal action is to choose $x_1 = x^A$ and $\mathbf{c}_1 = \mathbf{c}^\circ$, and thus her payoff is:

$$u^A(x^A, \tilde{z}(\mathbf{c}^\circ)) - k(\mathbf{c}^\circ) + \delta^A u^A(x^P, 0). \tag{15}$$

While a general characterization of A's strategy depends on functional forms, several features are immediately obvious. First, for x^A sufficiently close to x^P (specifically, for all x^A such that $\gamma(x^A) \leq \tilde{z}(\mathbf{c}^\circ)$), the strategy of targeting and choosing $y = x^A$ yields A's best outcome in both periods. The last two strategies could therefore be adopted only if preferences are divergent enough so that the implementation level required to satisfy P at x^A is more than A would wish to invest, or $\gamma(x^A) > \tilde{z}(\mathbf{c}^\circ)$. Second, the strategy of investing $\mathbf{c}^\circ$ in x^A clearly becomes ideal if δ^A is very low.

Finally, the strategy of choosing $y \neq x_1$ is optimal if A cares relatively little about implementation but more so about policy. Thus both of the latter strategies might be observed when highly politicized agencies face a hostile legislature.

Agent-initiated policy opens the possibility of higher organizational capacity and implementation levels, as the initial policy choice might allow an agent to realize greater gains from her investments. These investments might benefit the principal as well. However, the agent also faces the possibility of renegotiation, which did not occur in the principal-initiated games.

4.2 Delegation

The principal's delegation problem can be addressed simply by adding P's choice between agent- and principal-initiated policy prior to A's choice of $\mathbf{c}_1$, and comparing payoffs between the two subgames.

General capacity. In equilibrium, delegation is followed by renegotiation of policy back to x^P. Using (1) and rearranging, P then delegates if:

$$u^P(x^P, \tilde{z}(\mathbf{c}_1^*)) - u^P(x^A, \tilde{z}(\hat{\mathbf{c}}_1^*)) \leq \delta^P \left[u^P(x^P, \tilde{z}(\hat{\mathbf{c}}_1^*)) - u^P(x^P, \tilde{z}(\mathbf{c}_1^*)) \right]. \tag{16}$$

Expression (16) states the intuitive condition that delegation occurs if the period 2 gain from capacity investment compensates for the (possible) loss in utility for moving policy from x^P to x^A. It is sufficient for establishing several equilibrium relationships, which are stated without proof. Clearly, the delegation choice depends on the weightings that players place on period 2 payoffs. A invests more if given delegation for low values of δ^A, and P values investment more for high values of δ^P. P might therefore be more willing to delegate when an agency is staffed by a higher proportion of political appointees, or in periods of high incumbency advantage. Likewise, if δ^A is high and δ^P is low, capacity investments become less important to P than immediate policy gains, and P retains policy authority. As x^A increases, the delegation decision requires P to trade off between the increased investment from delegation and the loss in policy in period 1. Under many (but not all) functional assumptions, P becomes less inclined to delegate as x^A and x^P diverge.

Specialized capacity. While delegation may sometimes benefit the principal under general capacity, the same is not true of specialized capacity. The next result establishes that P cannot benefit from a specialized agent. This occurs because the policies and investments implied by (14) and (15) are no better for P than those implied by (11). (This is most clear in (15), where P does worse than simply receiving x^P with no capacity investments in both periods.) P therefore cannot benefit from agent-initiated policy and delegation is weakly dominated.

Proposition 7 Delegation under specialized capacity. *In the SC game, P does not delegate.* ■

Proposition 7 is somewhat counter-intuitive because it contrary to what many models of delegation predict. Moreover, the result does not depend on any imperfect or asymmetric information. It is therefore worth emphasizing how delegation and specialization affects A's incentives. Without delegation, A faces a sometimes binding constraint of satisfying P, given by $\gamma(\cdot)$. Delegation can temporarily free A from this constraint, and the benefits naturally accrue to A.

The result does not necessarily imply that specialized agents never receive policy authority. In some cases, P is indifferent between delegating and not. Additionally, an agent may take advantage pre-existing statutory authority by applying it to a new area. This would force the principal to react to the agency's first move in targeting and setting policy. It is finally worth noting that because A is allowed to choose any policy in X under agent-initiated policy, this is a model of "full" delegation. However models of delegation commonly establish that the principal can do somewhat better by constraining *ex ante* the set of policies that the agent may choose (*e.g.*, Gailmard 2002, 2009).

5. Conclusions

A long recognized but under-examined role of organizations is that of providing the capacity to execute policy. Bureaucratic agencies and their principals both have an interest in quality implementation, independent of who chooses policy or the policy itself. But they may disagree over how much capacity should be provided for a given policy, in addition to disagreeing over ideal policies. Modeling the trade-offs between policy and capacity therefore substantially enriches a spatial model of policy choice and delegation.

The theory views legislation as an incomplete contract, where policy can be specified by a principal but organizational capacity, and hence implementation, arises from agency investment. This investment is non-contractible in the short run, and so neither its location nor its extent can be specified *ex ante*. This agenda-setting power disappears in the long run as the principal "learns" the capacity technology and possibly renegotiates both capacity and policy.

The results relate several variables in determining organizational capacity and policy choice, including preference divergence, discount factors, and especially the technology of capacity investments. A generalist agency anticipates that its investment will be appropriated by the principal. Thus capacity and implementation levels are decreasing in the difference in ideal points. To some extent, the principal may be able to offset this loss of investment through delegation.

By contrast, when capacity investments can be targeted, implementation levels may increase as the players' preferences diverge. This happens because the agency can induce a policy closer to its ideal by compensating the principal with a high level of investment. This policy will not be overturned and, if the principal values capacity highly, can be located close to the agency's ideal. Compared with the generalist case, the resulting combination of policy and capacity is often worse for the principal. As a result, political leaders will often have an incentive to ensure that civil servants are endowed with a generalist background.

The specialist case further suggests a theoretical basis for the concept of "bureaucratic autonomy," which analysts have long invoked informally to describe agencies that appear to be highly operationally independent (*e.g.*, Selznick 1957). In the model, the principal will acquiesce to an ideologically extreme specialist agency's initiative because of its prior capacity investments. The resulting policy compromise occurs even in the absence of delegation. Autonomy is therefore observationally distinct from the standard theoretical account of delegation, under which the principal grants policy authority to a "friendly" agency.

The general framework developed here is useful for examining empirically other connections between capacity and preferences, delegation, policy choice, agency structure, specialization, and politicization. For example, the model in Section 4 predicts that delegation requires an unspecialized agency with a low discount factor. One empirical implication might be that agencies with higher proportions of political appointees will be more likely to receive ambiguous policy instructions.

A significant extension the model would be to consider variations in the ability of the principal to renegotiate. In some cases, renegotiation might be more difficult than in the present model because of divided government or high fixed costs in the capacity technology. In others, renegotiation may be easier because the principal learns how the capacity technology works across its entire domain (so that $\mathbf{c}_2$ is unrestricted). The model gives us reason to surmise that the agency gains leverage from the inability to renegotiate, and therefore has an incentive to seek complex technologies which make her investments irreversible.

Appendix

Proof of Proposition 2. (i) Derived in the text.

(ii) To conserve on notation, I omit time subscripts throughout. I show that A's objective $V : \Re_+^m \times [x^P, \infty) \to \Re$ satisfies the conditions of Theorem 3 of Edlin and Shannon (1998). The first is continuity, which is assumed. Second, the choice domain ($\Re_+^m$) must be a properly partially ordered lattice, which holds trivially.[22] Third, the type space $[x^P, \infty)$ must be partially ordered, which, using the standard order, also holds trivially. Additionally $V(\cdot)$ must satisfy:

Supermodularity in $\mathbf{c}$. For any $i \neq j$, differentiation yields $\frac{\partial^2 V}{\partial c_i \partial c_j} = (1+\delta^A)\left[\frac{\partial u^A}{\partial z}\frac{\partial^2 z}{\partial c_i \partial c_j} - \frac{\partial^2 k}{\partial c_i \partial c_j}\right] \geq 0$. Theorem 6 of Milgrom and Shannon (1994) yields the result.

Strictly increasing differences in $(\mathbf{c}; -x^A)$. Noting that $x^A > x^P$, for any j, differentiation yields $\frac{\partial^2 V}{\partial c_j \partial x^A} = (1+\delta^A)\frac{\partial^2 u^A}{\partial z \partial x^A}\frac{\partial z}{\partial c_j} < 0$. Thus $\frac{\partial^2 V}{\partial c_j \partial(-x^A)} > 0$. Theorem 6 of Milgrom and Shannon (1994) yields the result.

Increasing marginal returns to some c_j. This follows from the fact that $\frac{\partial^2 V}{\partial c_j \partial(-x^A)} > 0$ over all possible c_j, x^A, for any j.

Observe that by the assumptions on $u^A(\cdot)$ and $k(\cdot)$, $\mathbf{c}^* \in \text{int } \Re_+^m$. By the theorem, for any sublattice $S \subset \Re_+^m$ satisfying $\mathbf{c}^* \in \text{int } S$ and $\mathbf{c}' = \arg\max_{\mathbf{c} \in S} V(\mathbf{c}; x^{A'})$, $\mathbf{c}' > (<)\ \mathbf{c}^*$ if $-x^{A'} > (<)\ -x^A$. Thus, $\mathbf{c}^*$ is strictly increasing in $-x^A$, or strictly decreasing in x^A. The result on z_1^* follows from the fact that $z(\cdot)$ is increasing in each c_j.

Proof of Proposition 3. In period 1, P chooses policy $y \neq x^P$ if $\tilde{z}(\mathbf{c}_1) \geq \gamma(y)$; otherwise P chooses x^P. Since $\tilde{z}(\mathbf{c}^\circ(x^P)) > \gamma(x^P) = 0$, A always prefers investing optimally in x^P to letting P choose $x^P \neq y$. Thus, $x_1^* = y^*$. In period 2, P can do no better than choosing $\mathbf{c}_2 = \mathbf{c}_1$, which results in the same calculation as in period 1. Thus, $x_2^* = y^*$.

To show that $y^* \in (x^P, x^A]$, note that because $\frac{\partial^2 u^i}{\partial z \partial x} > (=)(<)\ 0$ for $x < (=)(>)\ x^i$, holding z constant any policy $y \notin [x^P, x^A]$ is strictly dominated by either x^A or x^P for both players. Thus, A only invests in some $y^* \in [x^P, x^A]$. Finally, to show that x^P cannot be chosen, note that (i) $\tilde{z}(\mathbf{c}^\circ(x^P)) > \gamma(x^P)$; (ii) $\gamma(y)$ is continuous; and (iii) by Berge's Theorem of the Maximum, the concavity of $u^A(\cdot)$, and the continuity of $z(\cdot)$, $\tilde{z}(\mathbf{c}^\circ(y))$ is continuous in y. These facts imply the existence of a non-empty neighborhood of x^P within which $\tilde{z}(\mathbf{c}^\circ(y)) > \gamma(y)$, and thus there exists

[22] A partially ordered set X is a lattice if the least upper bound and greatest lower bound of any two elements are also elements of X. If $X = \Re_+^m$ and the standard component-wise order is used, then the least upper bound is simply the component-wise maximum, and the greatest lower bound is the component-wise minimum. X is properly partially ordered if all equivalence classes are singletons, which is true for the component-wise order.

some $y > x^P$ that A strictly prefers to investing in over x^P. Thus, $y^* > x^P$, completing the proof. ∎

Proof of Proposition 4. (i) By Proposition 3, $x_1^* = x_2^* = y^*$. Therefore in period 2, P wishes to maximize capacity, implying $\mathbf{c}_2^* = \mathbf{c}_1^*$. Also by Proposition 3, $y^* > x^P$. Since $z_1^* \geq \tilde{z}(\mathbf{c}^\circ(y^*))$ and $\tilde{z}(\mathbf{c}^\circ(y))$ is increasing in y on $[x^P, x^A]$, $\tilde{z}(\mathbf{c}^\circ(y^*)) > \tilde{z}(\mathbf{c}^\circ(x^P))$, and thus $z_1^* > \tilde{z}(\mathbf{c}^\circ(x^P))$. From the assumptions made on $z(\cdot)$, it follows immediately that $\mathbf{c}_2^* \geq \mathbf{c}^\circ(y^*) \geq \mathbf{c}^\circ(x^P)$, completing the proof.

(ii) If $x^A \leq x_c$, then A achieves her ideal policy and implementation levels by choosing $y^* = x^A$ and $\mathbf{c}_1^* = \mathbf{c}^\circ$, which results in $z_1^* = \tilde{z}(\mathbf{c}^\circ) \geq \gamma(x^A)$. Thus for $x^A \leq x_c$, z_1^* is constant in x^A.

To show the result for $x^A \in [x_c, x_c + \epsilon]$, note that if $y^* > x_c$, then it must be the case that A invests the minimum necessary to satisfy P: $z_1^* = \gamma(y^*)$. Since $\gamma(\cdot)$ is increasing, it is therefore sufficient to be show that y^* is increasing over $x^A \in [x_c, x_c + \epsilon]$, for some $\epsilon > 0$. Let $y^*(x^A)$ denote the set of optimal choices of y given x^A. Since $\gamma(x_c) = \tilde{z}(\mathbf{c}^\circ(x_c; x_c))$, it is clear that $y^*(x_c) = x_c$ is the unique solution at $x^A = x_c$. I consider the reduced problem where y is restricted to $[x_c - \epsilon', x_c + \epsilon']$ ($\epsilon' > 0$) and implementation levels are given by $\gamma(y)$. This problem will have two properties. First, it will have the same solution as the problem where y is chosen from X. Second, under this restricted domain, A's objective $V(\cdot)$ (11) satisfies the two conditions of Corollary 1 of Edlin and Shannon (1998). Verifying these properties and characterizing the intervals will be sufficient to prove the result.

I begin with the second property. The first condition is continuous differentiability of $V(\cdot)$, which is assumed. The second condition is that A's objective (11) has increasing marginal returns (*i.e.*, $\frac{dV}{dy}$ is increasing in x^A) in a neighborhood of x_c. Differentiating (11) yields:

$$\frac{dV}{dy} = (1 + \delta^A) \left[\frac{\partial u^A}{\partial y} + \frac{\partial u^A}{\partial \gamma} \frac{d\gamma}{dy} - \sum_{j=1}^{m} \frac{\partial k}{\partial \underline{c}_j} \frac{d\underline{c}_j}{dy} \right]. \tag{17}$$

Observe that of the terms in (17), $\sum_j \frac{\partial k}{\partial \underline{c}_j} \frac{d\underline{c}_j}{dy}$ and $\frac{d\gamma}{dy}$ are independent of x^A. Additionally, the marginal effect of x^A (fixing y) on $u^A(\cdot)$ is identical to that of $-y$ (fixing x^A). Thus, $\frac{dV}{dy}$ is increasing in x^A if $-\frac{\partial^2 u^A}{\partial y^2} - \frac{\partial^2 u^A}{\partial \gamma \partial y} \frac{d\gamma}{dy} > 0$, or equivalently:

$$-\frac{\partial^2 u^A}{\partial y^2} \Big/ \frac{d\gamma}{dy} > \frac{\partial^2 u^A}{\partial \gamma \partial y}. \tag{18}$$

To show that (18) holds in some non-empty neighborhood of x_c, note the following three facts. (a) By assumption on $u^A(\cdot)$, $-\frac{\partial^2 u^A}{\partial y^2}$ is strictly positive and bounded away from zero. (b) By the the fact that $\gamma(\cdot)$ is non-decreasing and bounded in any neighborhood of x_c, $\frac{d\gamma}{dy}$ is non-negative and bounded from above. These imply that in any neighborhood of x_c, the left-hand side of (18) is bounded from below by some $\eta' > 0$. (c) By assumption on $\frac{\partial^2 u^A}{\partial\gamma\partial y}$, for any $\eta'' > 0$ there exists a non-empty neighborhood of x^A such that $\left|\frac{\partial^2 u^A}{\partial\gamma\partial y}(y)\right| < \eta''$.

Now choosing $\eta'' < \eta'$, there exists an interval $[x_c - \epsilon', x_c + \epsilon']$, where $\epsilon' > 0$, such that (18) holds for all y, x^A contained within. Recalling that x_c is the unique solution to (11) when $x^A = x_c$, this implies that for $x^A \in [x_c, x_c + \epsilon']$, the first-order condition is strictly increasing in x^A over $(x_c - \epsilon', x_c + \epsilon')$. Thus for any $x^A \in [x_c, x_c + \epsilon']$, the first-order necessary condition for maximization cannot be satisfied at any $y \in [x_c - \epsilon', x_c]$.

To verify the first property, recall from the discussion of Section 3.2 that any $x^A > x_c$ induces some $y_c < x_c$, and that $y^* \in [y_c, x^A]$ and $z_1^* = \gamma(y^*)$. The property is therefore satisfied if:

$$[y_c, x^A] \subset (x_c - \epsilon', x_c + \epsilon'). \tag{19}$$

Now select $\epsilon \in (0, \epsilon')$ such that $x^A = x_c + \epsilon$ induces y_c satisfying (19). Existence of such an ϵ follows from the continuity of $\gamma(\cdot)$ and $\tilde{z}(\mathbf{c}^\circ(\cdot))$ and the fact that $\epsilon = 0$ satisfies (19) trivially. Note that this selection guarantees an interior solution in $[x_c - \epsilon', x_c + \epsilon']$.

The corollary implies that any interior selection of maximizers $y^*(x^A)$ is increasing in x^A on $[x_c - \epsilon', x_c + \epsilon']$. Thus the maximum value of $y \in [x_c, x_c + \epsilon']$ satisfying the first order condition of (11) is strictly increasing in x^A. Since A must choose the value in $y^*(x^A)$ closest to x^A, she chooses $\max y^*(x^A)$. Hence y^* is increasing in x^A over $x^A \in [x_c, x_c + \epsilon]$.

(iii) I show that A's objective $V(\cdot)$ (11) satisfies the two conditions of Corollary 1 of Edlin and Shannon (1998). The first is continuous differentiability, which is assumed.

The second condition is increasing marginal returns; *i.e.*, $\frac{dV}{dy}$ is increasing in x^A, which, by part (ii), is satisfied if (18) holds. By the argument in part (ii), the left-hand side of (18) is bounded from below by some $\eta' > 0$ for all $x^A \geq x_c$ and $y \geq x^P$. (For obvious reasons I disregard $y < x^P$.) By the boundedness of $\frac{\partial^2 u^A}{\partial\gamma\partial y}$, there exists some $\underline{p} > 0$ such that $\frac{\partial^2 u^A}{\partial\gamma\partial y} < \eta'$ if $p \leq \underline{p}$ for all $x^A \geq x_c$ and $y \geq x^P$.

Thus by the corollary, if $p \leq \underline{p}$, then $\frac{dV}{dy}$ is increasing in x^A and any interior selection from the set $y^*(x^A)$ of maximizers of $V(\cdot)$ on X is strictly increasing. That $y^* \in \operatorname{int} X$ follows from the argument in the proof of Proposition 3, which established that $y^* \in (x^P, x^A]$. Thus, y^* is strictly increasing in x^A over $[x_c, \max X]$.

Finally, by the discussion of Section 3.2, for any $x^A > x_c$ we have $z_1^* = \gamma(y^*)$. Since $\gamma(y)$ is strictly increasing, the same comparative statics apply to z_1^* as to y^*. ■

Proof of Proposition 5. Since there is no renegotiation and $\mathbf{c}_2^* = \mathbf{c}_1^*$ in equilibrium, it is sufficient to show the result for $U^i(x_1^*, y^*, \mathbf{c}_1^*)$. For notational convenience, I omit time subscripts.

(i) By Proposition 2, A receives $U^A(x^P, x^P, \mathbf{c}^\circ(x^P))$ in the GC game. In the SC game, since $\frac{\partial u^A}{\partial z}$ is increasing on $[x^P, x^A]$, $U^A(x, x, \mathbf{c}^\circ(x)) > U^A(x^P, x^P, \mathbf{c}^\circ(x^P))$ for any $x \in (x^P, x^A]$. Observe that by the assumptions on $u^i(\cdot)$ and $z(\cdot)$, we have $\gamma(0) = 0$ and $\tilde{z}(\mathbf{c}^\circ(x^P)) > 0$. Thus the continuity of $u^i(\cdot)$ implies the existence of some $y' \in (x^P, x^A)$ satisfying $\tilde{z}(\mathbf{c}^\circ(y'; x^A)) > \gamma(y')$, which implies $U^P(y', y', \mathbf{c}^\circ(y')) > U^P(x^P, x^P, \mathbf{c}^\circ(x^P))$. Thus if A were to choose $y = y'$ and invest $\mathbf{c}^\circ(y')$, P would choose $x = y'$ and not renegotiate. Hence $U^A(x^*, x^*, \mathbf{c}^\circ(x^*)) \geq U^A(y', y', \mathbf{c}^\circ(y'))$. Combining inequalities yields $U^A(x^*, x^*, \mathbf{c}^\circ(x^*)) > U^A(x^P, x^P, \mathbf{c}^\circ(x^P))$.

(ii) By Proposition 2, P receives $U^P(x^P, x^P, \mathbf{c}^\circ(x^P))$ in the GC game. In the SC game, by (8), $z^* = \max\{\gamma(y^*), \tilde{z}(\mathbf{c}^\circ(y^*; x^A))\}$. If $z^* = \gamma(y^*)$, then $U^P(x^*, y^*, \underline{\mathbf{c}}(x^*)) = U^P(x^P, x^P, \mathbf{0}) < U^P(x^P, x^P, \mathbf{c}^\circ(x^P))$. Thus it is sufficient to show that $z^* = \gamma(y^*)$ for $x^A \geq x_c$. Observe that since $\gamma(0) = 0$ and $\tilde{z}(\mathbf{c}^\circ(y; x^A)) > 0$ for any $y \in [x^P, x^A]$, $x^A \geq x_c$ implies that there exists some $y_c < x_c$ such that $\gamma(y_c) = \tilde{z}(\mathbf{c}^\circ(y_c))$ and $\gamma(x) > \tilde{z}(\mathbf{c}^\circ(x))$ for all $x \in (y_c, x^A]$. By the argument in Section 3.2, A prefers $y = y_c$ and $\mathbf{c} = \mathbf{c}^\circ(y_c)$ to any $y < y_c$ associated with any capacity investment, and therefore $y^* \geq y_c$. Thus by (8), $z^* = \gamma(y^*)$ for $x^A \geq x_c$. ■

Proof of Proposition 6. (i) Derived in the text.

(ii) The proof is virtually identical to that of Proposition 2(ii) and is omitted.

(iii) To conserve on notation, I omit time subscripts throughout. It is sufficient to show the result for $\hat{\mathbf{c}}^*$, as $\tilde{z}(\cdot)$ is strictly increasing in $\mathbf{c}$. The concavity of $V(\cdot)$ and $\hat{V}(\cdot)$ imply that first order conditions are sufficient to characterize solutions for both (12) and (5). By the fact that $\frac{\partial^2 u^A}{\partial z \partial x} > 0$ for $x \in [x^P, x^A)$, $\frac{\partial \hat{V}}{\partial c_j} > \frac{\partial V}{\partial c_j}$ for all c_j $(j = 1, \ldots, m)$. The result therefore obtains if the solution of the agent-initiated game (12), $\hat{\mathbf{c}}^*$, is interior. This follows from the fact that, by assumption on $U^A(\cdot)$, $\frac{\partial \hat{V}}{\partial c_j}(\mathbf{0}) > 0$ for all j, and thus $\hat{\mathbf{c}}^* \neq \mathbf{0}$. ■

Proof of Proposition 7. It is sufficient to show that P never benefits from any strategy in which A chooses: (i) $x_1 = x^A \neq y$, characterized by (14), or (ii) $x_1 = x^A = y$, characterized by (15). In both cases it can be assumed that $\gamma(x^A) > \tilde{z}(\mathbf{c}^\circ)$, for otherwise in equilibrium with or without delegation, $x_1^* = y^* = x^A$, A invests $\mathbf{c}^\circ(x^A)$, and P would not renegotiate.

In both cases, I show that P's payoffs from these strategies are less than her "reservation" payoff under the equilibrium principal-initiated game strategy, whereby P chooses $x_1 = y^*$. Since equilibrium policies must provide an implementation level of at least $\gamma(y^*)$, P's expected payoff with principal-initiated policy is at least $r = (1 + \delta^P) u^P(x^P, 0)$.

(i) In period 1, $u^P(x^A, 0) < u^P(x^P, 0)$. For period 2, I use an argument analogous to that in Section 3.2 to show that the implementation level lies along $\gamma(\cdot)$. Let $\hat{y}_c \equiv \max\{y \mid \gamma(y) = \tilde{z}(\hat{\mathbf{c}}^\circ(y; x^A))\}$ denote the policy closest to x^A such that $\gamma(\cdot)$ and $\tilde{z}(\cdot)$ intersect under this strategy. The existence of $\hat{y}_c$ follows from the facts that $\gamma(x^A) > \tilde{z}(\mathbf{c}^\circ)$, $\gamma(x^P) = 0$ and $\tilde{z}(\hat{\mathbf{c}}^\circ(x^P; x^A)) > 0$. Then by the definition of $\tilde{z}(\cdot)$ and the assumptions on $u^A(\cdot)$, A must prefer policy $\hat{y}_c$ with implementation level $\tilde{z}(\hat{\mathbf{c}}^\circ(\hat{y}_c; x^A))$ to any target policy $y < \hat{y}_c$ with any implementation level. Thus the solution satisfies $\hat{y}^* \in [\hat{y}_c, x^A]$. Since $\gamma(x^A) > \tilde{z}(\hat{\mathbf{c}}^\circ(y; x^A))$ for $y > \hat{y}_c$, to prevent renegotiation the equilibrium implementation level must be $\gamma(\hat{y}^*)$. This implies that P's period 2 payoff is $u^P(x^P, 0)$. P's expected payoff under this delegation strategy is therefore $u^P(x^A, 0) + u^P(x^P, 0)$, which is less than r.

(ii) Since A chooses x^A and invests $\mathbf{c}^\circ$ under this delegation strategy and $\gamma(x^A) > \tilde{z}(\mathbf{c}^\circ)$, P's period 1 payoff satisfies $u^P(x^A, \tilde{z}(\mathbf{c}^\circ)) < u^P(x^P, 0)$. P also receives $u^P(x^P, 0)$ in period 2. Thus P's payoff is strictly less than r. ■

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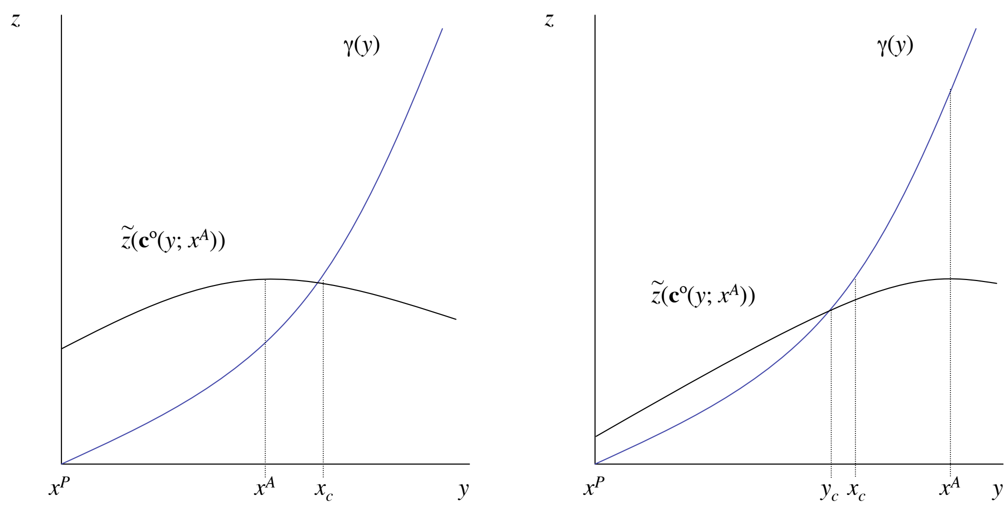

Figure 1: *Two equilibrium cases under specialized capacity.* In the left graph, $x^A < x_c$ and thus $\tilde{z}(\mathbf{c}^\circ(x^A; x^A)) > \gamma(x^A)$. A is therefore able to invest optimally in her ideal policy without renegotiation by P. In the right graph, $x^A > x_c$ and thus $\tilde{z}(\mathbf{c}^\circ(x^A; x^A)) < \gamma(x^A)$, so A cannot invest optimally in x^A without renegotiation. Since she prefers policy y_c and capacity $\tilde{z}(\mathbf{c}^\circ(y_c; x^A))$ to all policies and capacity levels along the schedule implied by $\tilde{z}(\mathbf{c}^\circ(y; x^A))$ for $y < y_c$, her solution must lie along the schedule implied by $\gamma(y)$ for some $y \in [y_c, x^A]$.

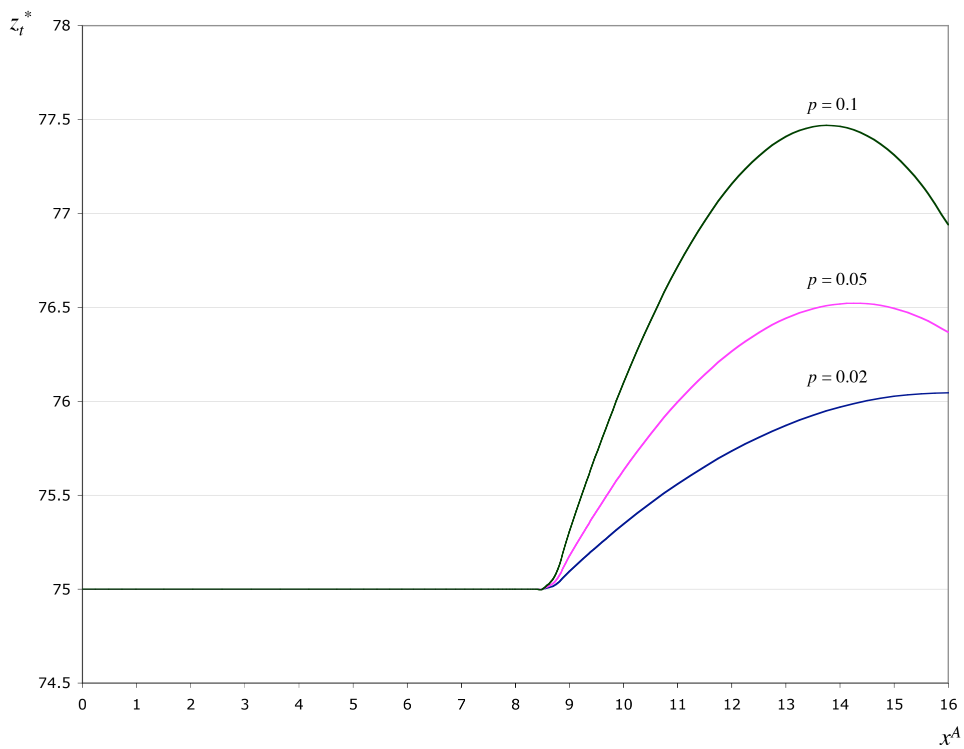

Figure 2: *Equilibrium implementation levels under specialized capacity.* In the neighborhood of x_c, implementation is strictly increasing in x^A. For high values of p, implementation is not monotonically increasing in x^A, while for the lowest value of p, implementation is strictly increasing.