

A LABOR MARKET THEORY OF BUREAUCRATIC POLITICS¹

- Working Paper -

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Abstract

This paper advances a theory of bureaucratic politics rooted in the transactional logic of labor markets. Bureaucratic jobs are temporary matches of individuals with governments, which form when individuals and governments accept each other's offers to exchange labor for pay. The job persists until one or both exits. We argue that the processes of job formation and exit affect agents and principals simultaneously—that is, transaction costs and the relative scarcity or abundance of bureaucratic labor—simultaneously constrain and incentivize both principals and agents. We develop the argument formally with a two-player game in which principals and agents both face adverse selection and moral hazard problems. Equilibrium conditions show how bureaucratic skill and ambition interact with governments' vigilance and policy preferences to shape bureaucratic politics. We show that labor markets condition relationships between bureaucrats and politicians, and so explain important political outcomes that existing theories do not.

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This paper advances a theory of bureaucratic politics rooted in the logic of public administration labor markets. Much of the prominent research on bureaucratic politics in political science uses a principal-agent framework to depict the relationships between politicians and bureaucrats, with an analytical focus on politicians' efforts to control bureaucrats. Meanwhile, "bureaucentric" theories—many developed in the public administration field—tend to emphasize administrators' motives and professionalism to explain bureaucratic political behavior. Although each line of theory has merit, each has significant limitations. Most principal-agent models are built upon empirically dubious assumptions about bureaucrats and predict politicians' decisions more accurately than they do bureaucrats'. Theories in the public administration tradition perhaps enjoy greater verisimilitude, but frequently lack elegance and tend to focus on bureaucrats' behavior while neglecting politicians'.

Critically, both theoretical traditions tend to depict politicians and bureaucrats as homogeneous actors in static relationships, which limits the extent to which they can explain bureaucratic politics. Why are some bureaucrats active in the policymaking process, tirelessly championing innovative policies in the face of political resistance, when others are not? Why do politicians sometimes tolerate shiftless, incompetent, or rebellious bureaucrats? Why do politicians sometimes fire competent, hard-working bureaucrats? Why do bureaucrats sometimes behave in ways that are likely to get them fired? Why do bureaucrats who enjoy and excel at their jobs sometimes quit?

We seek to improve upon existing theories of bureaucratic politics by starting with three assumptions that depart from the main theoretical traditions: that 1) governments and bureaucrats are heterogeneous; 2) employment relationships between governments and bureaucrats are voluntarily and temporary; and 3) both skilled bureaucratic labor and government positions are subject to scarcity. Following works on bureaucratic politics that emphasize bureaucratic

heterogeneity (Downs 1967; Prendergast 2007; Gailmard and Patty 2013) and job mobility (Adolph 2013; Maranto and Wolf 2013; Teodoro 2011), we cast bureaucrats and governments as sellers and buyers of public administration labor in a competitive market. Proceeding from what Carpenter and Krause (2014) have called a “transactional authority” perspective, we recognize that politicians and bureaucrats are mutually dependent and mutually constrained co-producers of public policy. We argue that labor markets shape relationships between administrators and governments, and so influence their respective behaviors. The result is a novel, generalizable model that generates counterintuitive predictions about both politicians and bureaucrats, reconciles existing theories in political science and public administration, and explains phenomena that existing theories do not.

We begin with a brief, synthetic review of two major theoretical traditions on bureaucratic politics, with special attention to the ways in which the two lines of research diverge and the important theoretical questions that they leave unanswered. We end our review with discussion of theories that recognize bureaucratic heterogeneity and job mobility, which serves as our point of theoretical departure. After articulating its logic, we discuss the model’s advantages and derive several hypotheses from it. We conclude by discussing the theory’s limitations and laying out an agenda for its refinement, and extension.

Disconnects in theories of bureaucratic politics

Broadly, research on bureaucratic politics has progressed along two avenues: 1) principal-agent models, developed mostly within political science; and 2) bureaucentric models, developed most thoroughly within the public administration literature. The two lines of research relate to each other, but also diverge in ways that limit each and invite a more comprehensive theory of bureaucratic politics.

Principal-agent theory and the political control of the bureaucracy

Since its emergence in the early 1970s (e.g., Niskanen 1971, 1975), principal-agent theory (PAT) has become the predominant theoretical framework for political science research on the bureaucracy. Rooted in the economic theory of insurance and labor contracts, PAT depicts politicians as principals who contract with bureaucratic agents to carry out public policy. Agents and principals are assumed to have different preferences, and agents are assumed to enjoy informational advantages over their principals concerning their qualifications and preferences (the “adverse selection” problem) and their actions on the job (the “moral hazard” problem). Principals therefore use monitoring, procedural constraints, and/or rewards in order to influence agents’ behaviors. Principals do not bargain with agents, but rather impose ultimatum conditions designed to ensure that agents carry out their duties. Political scientists have variously refined, extended, and/or relaxed various parts of the basic PAT framework. A thorough review of the political science research on bureaucratic politics using PAT is beyond the scope of this paper; see Moe (1984) and Miller (2005) for excellent essays on PAT in political science. At its best, PAT offers parsimonious, intuitive explanations of bureaucratic politics.

Importantly, PAT proceeds from the perspective of politicians who seek to control bureaucrats and has been framed with a normative concern for the “political control of the bureaucracy” (although often the normative motivation is implicit). Partly as a consequence of that normative interest, political scientists have aimed their theorizing about bureaucracy not at bureaucrats, but rather at politicians. That is, PAT is most often used to explain and predict principals’ choices of monitoring and procedural mechanisms (Bendor, Taylor and Van Gaalen 1987; Epstein and O’Halloran 1994; Huber and Shipan 2002; McCubbins and Schwartz 1984, Niskanen 1971, among many others).

For a variety of reasons, PAT is less useful in explaining agents’ behaviors. As Waterman

and Meier (1998) observed, many of PAT's difficulties in explaining bureaucratic behavior stem from the theory's stylized assumptions. With few exceptions, PAT assumes that principals (politicians) and agents (bureaucracies) are unitary actors. The unitary actor assumption is analytically convenient, but contravenes much of what political scientists know about politicians and organizational theorists know about bureaucracies: legislatures and agencies are composed of individuals with diverse abilities and preferences (a point to which we return later). The PAT assumption that politicians are first-moving, ultimatum actors sits uncomfortably with a vast empirical literature on the public policy process that identifies administrators as independent, even autonomous, political actors (Carpenter 2001; Schneider, Teske and Mintrom 1995). Accordingly, PAT's predictions about variation in bureaucratic behavior have fared poorly when subject to rigorous empirical testing (Balla 1998; Brehm and Gates 1997; Ringquist 1995; Wood 1988).

Bureaucentric models

A second line of research on bureaucratic politics focuses on administrators and agencies. This body of research is more theoretically and methodologically diverse, often employing ideas from organizational theory, social psychology, history, and sociology. What bureaucentric models hold in common is attention to bureaucrats' norms and/or rationality. Typically the units of analysis in these bureaucentric models are individual administrators, who act pursuant to autonomy (e.g., Carpenter 2001), public service (e.g., Perry 1997), specific policies (e.g., Downs 1967; O'Leary 2006), or some other goal. Professionalism is frequently identified as a predictor of bureaucratic behavior in this vein of research, as bureaucrats make decisions consistent with the norms and values of their professions, even in defiance of their putative principals and at risk to their own jobs (Wilson 1989; Miller and Whitford 2016).

Among the many merits of bureaucentric theories are their attention to microfoundations and the recognition of administrators as actors with their own political interests. But the processes

that generate or condition bureaucrats' preferences are exogenous to most bureaucentric theories, and so variation among bureaucrats remains poorly unexplained. For example, if bureaucrats make choices consistent with professional norms, why do some bureaucrats behave more professionally than others? If bureaucrats seek autonomy, why do some pursue autonomy more vigorously than others? Many bureaucentric theories essentially beg the question: bureaucrats serve the public because they are public service-motivated, act professionally because they are professionals, or pursue autonomy because they prefer autonomy, and so on.

Missing links

Three important limitations are common to both principal-agent and bureaucentric theories. First, with few exceptions, both theoretical traditions depict static relationships between bureaucrats and politicians. That is, PAT and bureaucentric models largely leave aside the possibility that principal, or agent, or both might voluntarily exit the relationship in pursuit of another. Second, again with few exceptions, both theoretical traditions assume that bureaucrats and governments are homogeneous. In PAT, homogeneity is implicit in the unitary actor assumption. And, as noted above, most bureaucentric models are populated by homogeneous bureaucrats, despite their roots in individual administrators' rationality. Third, neither PAT nor bureaucentric theories consider the "macroeconomics" of the bureaucrat-government relationship: both approaches implicitly assume a single government employer, an infinite supply of bureaucrats, and no significant competition for bureaucratic labor. We now turn to a handful of models that relax some of these assumptions.

Mobility. A little-noted assumption underlying Niskanen's (1975) applications of PAT in political science is that principal and agent interact in a "bilateral monopoly" (618).² In fact, conscription aside, bureaucrats and governments are producers and consumers of labor in a competitive market. Bureaucratic jobs are not eternal, and public administration research has given

² Niskanen (1975) assumed a bilateral monopoly between a "bureau" and a "government review group" (618).

significant attention to the effects of turnover on performance (e.g., Meier and Hicklin 2007).

Recently political scientists have begun to pay attention to the political effects of bureaucratic job mobility. One line of research connects mobility to policy innovation, finding that bureaucratic executives who move between governments are more likely to champion innovative policies than are executives who are promoted from within (LeRoux and Pandey 2008; Maranto and Wolf 2013; Teodoro 2009; Villadsen 2012). Others show that the possibility of job exit (voluntary or involuntary) significantly affects bureaucrats' political incentives (Lee and Whitford 2008; Connolly 2017). A common theme emerges from these works: bureaucratic jobs are temporary, and the processes of job formation and exit condition relationships between bureaucrats and politicians. Badly needed is a general theory for analyzing the political consequences of bureaucratic job mobility.

Heterogeneity. Research on the competence-loyalty tradeoff in the bureaucracy recognizes heterogeneity across bureaucrats. Politicians prefer competent bureaucrats insofar as they prefer effective policy, but also may fear that highly-qualified bureaucrats hold preferences that diverge from the politicians' (Hollibaugh 2014). Politicians sometimes opt for less competent but more loyal bureaucrats when hiring if the bureaucrats have significant policy influence (Bertelli and Feldmann 2007; Gallo and Lewis 2012; Krause and O'Connell 2015; Lewis 2007). Although this literature recognizes bureaucratic heterogeneity in the loyalty-competence tradeoff, it follows the PAT tradition in casting politicians as unitary, first-moving, ultimatum actors. The labor market also receives scant theoretical attention in this research; the tacit assumption is that a supply of loyal or competent bureaucrats is always available, and that a competent bureaucrat would never decline employment or quit voluntarily. Finally, although this research pays a great deal of attention to

bureaucratic appointments, it says much less about job termination.³ When and why do politicians fire bureaucrats? When and why do bureaucrats quit?

The bureaucrats in Downs' *Inside Bureaucracy* (1967) are both heterogeneous and mobile. Downs lays out a taxonomy bureaucrats based on their motivations—including *climbers*, *conservers*, and *zealots*—and then theorizes about how each type responds to incentives. Climbers aggrandize themselves in order to be attractive candidates for promotion, sometimes by “jumping” from one agency to another (95); conservers are risk-averse and conform to organizational norms because they want to remain in their current posts. Zealots pursue narrowly-defined policy goals energetically.

Following suit, Gailmard and Patty (2007; 2013) develop a model with two types of agents that enjoy some job mobility: *zealots* (who are policy-motivated) and *slackers* (who are not).⁴ They argue that principals grant discretion and job protections to bureaucrats in order to attract zealots and discourage slackers: given adequate discretion, zealots will work faithfully at lower cost than will slackers, who will leave government employment for higher pay elsewhere. Similarly, Prendergast (2007) theorizes that principals sometimes prefer to hire policy-biased bureaucrats because a policy-motivated agent will sacrifice wages for policy-related effort. These theories are important advances for at least three reasons: 1) they include the agent's employment decision alongside the principal's; 2) they recognize heterogeneity among bureaucrats; and 3) they introduce one way in which labor markets condition the political relationship between principal and agent. However, both theories are also limited in important ways. First, bureaucratic expertise is endogenous to Gailmard and Patty's governments—that is, governments do not select expert bureaucrats, but rather bureaucrats develop

³ McCarty (2004) includes presidential removal of appointees, but is more a model of inter-branch politics (i.e., president vs. legislature) than of bureaucratic politics.

⁴ Gailmard and Patty's (2007) *zealots* are different from Downs' (1967) *zealots*. Gailmard and Patty's zealots are willing to sacrifice some margin of salary in exchange for the satisfaction of policy-related public service (see also Prendergast 2007). Downs' zealots are similarly policy-motivated, but also are evangelical pursuers of narrowly-defined policy goals. Gailmard and Patty's zealotry is closer to what public administration scholars have called “public service motivation” (Perry 1997).

expertise by serving in an agency. This assumption allows Patty and Gailmard to model investment in human capital development, but stands at odds with a great deal of what we know empirically about how governments actually select bureaucrats (Maranto and Milliman 2009; Wilson 1989), and leaves aside the possibility that a government might hire a fully-competent zealot from outside, as Prendergast (2007) suggests (see also Hamidullah, Wilkins and Meier 2009). Second, both Prendergast (2007) and Gailmard and Patty (2007, 2013) disregard the macroeconomics of bureaucratic labor: their models assume infinite supplies of bureaucrats (when an agent leaves, a new bureaucrat simply appears), and that there is only one government buyer of bureaucratic labor—that is, a bureaucrat cannot leave one agency in order to take a job with another.⁵

Adolph (2013) and Teodoro (2011) also combine heterogeneity with job mobility. Adolph links bureaucrats' career backgrounds and ambitions to their political behavior, arguing that bureaucrats' potential future employers are “shadow principals” that influence bureaucrats' choices with the promise of future jobs. In a similar vein, Teodoro (2011) argues that ambitious bureaucrats seek to advance their careers by moving from one agency to another, and so work to cultivate reputations that will appeal to other government employers. But neither of these works addresses the aggregate supply of or demand for bureaucratic labor. Moreover, bureaucrats are the main political actors in these accounts, leaving politicians under-theorized: neither Adolph nor Teodoro explains why politicians reward or tolerate bureaucrats who serve “shadow principals” instead of their actual principals.

Hardly any political science research at all has addressed the political significance of heterogeneity among governments under bureaucratic job mobility. The neglect of inter-government heterogeneity likely occurs because models of bureaucratic politics typically include only a single

⁵ Gailmard and Patty's (2007) assumptions make their model most applicable to military organizations: endogenous expertise, virtually limitless supply of bureaucrats available through conscription, and only a single government buyer of labor.

government. In reality, bureaucrats can serve many agencies across many governments. How do differences in governments condition bureaucrats' political decisions when they may change jobs at will?

The macroeconomics of bureaucratic labor. The existence of job mobility involving heterogeneous bureaucrats and governments implies the existence of a labor market, and thus aggregate supply and demand. Studies of comparative political economy has long recognized the availability of skilled labor as an important driver of and constraint upon both economic and state development (Thelen 2004; Wilensky 2002). Reciprocally, the growth and development of the state has been linked to the expansion of career opportunities for bureaucrats (Roos 1978; Skocpol, Ganz and Munson 2000). If bureaucratic labor markets function similarly to other markets, it is reasonable to expect that macro conditions affect micro-level relationships between buyers and sellers. Applied to bureaucratic politics, we would expect the relative abundance or scarcity of skilled administrators and government employers to affect the political relationships between principals and agents. Research on the macroeconomics of labor has evolved separately from research on bureaucratic politics, however. We are aware of no theories of bureaucratic politics that account for the relative abundance or scarcity of bureaucratic labor.

Bureaucratic labor is different. A vast literature on labor markets in economics analyzes the processes that connect heterogeneous workers and employers in jobs. Canonical labor market models depict the job matching process a repeated incomplete information game in which workers maximize wages and employers maximize productivity (Jovanovic 1979; Topel 1986; Petrongolo and Pissarides 2001).

Typical labor matching models offer less purchase on many questions that are important to political scientists. With multiple constituencies and ambiguous and oft-conflicting goals, governments lack clear standards of productivity by which to gauge employees (Wilson 1989).

Moreover, with so much of the public policy process in the hands of bureaucrats, politicians must weigh employees' policy preferences alongside their productivity in a way that private sector employers typically do not—the “competence-loyalty tradeoff” does not show up in the typical labor market matching model, even when career concerns do (Dewatripont, Jewitt and Tirole 1999; Topel and Ward 1992). In bureaucratic politics, the principal may be as much concerned for the agent's policy preferences as for her productivity. In this sense, a labor market theory of bureaucratic politics is more complicated than a labor market theory of production because the politician must balance productivity and policy preference (i.e., competence and loyalty), while the firm manager maximizes only productivity.

Toward an integrated theory

To summarize, theories of bureaucratic politics in the PAT and bureaucentric traditions remain estranged from one another, in part because they fail to incorporate three crucial, empirically consistent, and ubiquitous conditions of political life: job mobility, heterogeneity among bureaucrats and governments, and relative scarcity or abundance of bureaucratic labor. Recent research has begun to recognize these conditions, and so provides building blocks for an improved general theory of bureaucratic politics.

A labor market theory of bureaucratic politics

Here we advance a model of bureaucratic politics that is rooted in the logic of public administration labor markets. This Labor Market Theory (LMT) is general insofar as it seeks to explain simultaneously the behaviors of both principals and agents across many contexts. The model retains the elegance of canonical PAT, but is more realistic in its assumptions. Although LMT's logic is consistent with PAT, it generates some new and counterintuitive implications, while reconciling PAT with important bureaucentric theories. Embracing a transactional authority perspective (Carpenter and Krause 2014), the theory offered here casts bureaucrats and politicians as mutual and

simultaneous actors in the policy process. Here we lay out the elements of the model, identify its main assumptions, express its logic in game theoretical terms, and establish some equilibrium outcomes. In the next section we discuss the LMT's implications for analysis of bureaucratic politics.

Elements of the model

Bureaucratic politics—that is, the strategic political decisions of politicians and bureaucrats in relation to each other—occur within bureaucratic *jobs*, which are temporary matches of individuals with governments. Jobs form in a market composed of a finite set of government principals P and a finite set of bureaucratic agents A . In this market, governments (principals) are buyers and bureaucrats (agents) are sellers of labor. A job j_{pa} forms when a government $p \in P$ offers pay to a bureaucrat $a \in A$ in exchange for labor and a accepts the offer (alternatively, a can offer labor to p in exchange for pay and p can accept the offer). Job j_{pa} persists until either p or a decides to exit the relationship.⁶ An agent exits by quitting pursuant to another job or retirement; a principal exits by firing the agent.

In the rational choice tradition, we cast principals and agents as utility-maximizing actors, and the bureaucratic labor market itself as an exogenous institution that shapes and constrains their decisions. Principals and agents behave strategically with respect to each other, but the labor market and processes of job formation and exit inform their decisions.

Modeling assumptions

LMT rests upon five basic assumptions, all of which are consistent with common knowledge about or past research on bureaucratic politics.

Assumption 1: goals. *Governments seek policy outcomes, while bureaucrats seek to maximize career objectives.* These are straightforward assumptions about utility maximizing for principals and agents

⁶ In the basic model governments are the only buyers of labor; this assumption can be relaxed to add non-government buyers of labor to the system, following Gailmard and Patty (2007) and Adolph (2013).

under LMT. We follow PAT in assuming that principals are concerned with development and execution of policy. This assumption precludes that idea that politicians hire bureaucrats as a means of patronage to reward electoral support or ethnic solidarity (Johnston 1979).

Similarly, LMT assumes that bureaucrats are entirely motivated by their career aims. We leave aside pure, altruistic public service motivation and ideology in the basic model for two reasons. First, in its basic formulation, LMT assumes that all buyers of bureaucratic labor are governments, so all bureaucratic jobs are by definition public service jobs. Consequently, public service motivation is a constant in the basic model, not a variable.⁷ Second, “the public interest” is a sufficiently broad concept that it can accommodate nearly any degree of public service motivation. “No single conception of the public interest can be unequivocally identified as ‘the one best’ version,” Downs (1967) observes, and so “each official pursues the public interest as he himself perceives it” (101).

These assumed goals are somewhat narrow, but not restrictive. The basic LMT can be expanded or relaxed to allow for additional goals like patronage among principals or policy-specific zealotry among agents. We return to these ideas in the conclusion.

Assumption 2: heterogeneity. *Governments and bureaucrats vary in their preferences and characteristics.* Due to differences in institutional structure, population, public opinion, or environmental conditions, governments vary in their preferences over policy. Governments also vary in their vigilance over their bureaucrats: some closely scrutinize their agents’ behavior, while others may pay less attention or be more tolerant of deviation from their policy preferences. Just so, bureaucrats vary in their degree of career ambition: we assume that some bureaucrats are *ambitious*

⁷ In this sense, Gailmard and Patty (2007; 2013) and Prendergast (2007) be considered special cases of our general LMT with a single government employer. Their models equate exit from a bureaucratic job with exit from public service, and so policy-motivated bureaucrats suffer a loss of utility from job exit. Under LMT, public service-motivated bureaucrats do not incur such a loss because all employers are governments. Just like Downs’ (1967) *climbers*, ambitious bureaucrats under LMT may advance their careers by leaving one government agency to take a position in another without forsaking their zeal.

for advancement to higher-status jobs, while others are not ambitious, and so seek only to maintain their current posts. Bureaucrats also are more or less skilled.

An implication of this variation is that the governments and bureaucrats that comprise the market have distributions that are exogenous to any specific government or bureaucrat. Within the set of bureaucrats \mathcal{A} , the skill level of the median bureaucrat \tilde{a} represents the market's overall level of skill. Assuming single-peaked preferences arrayed on a single dimension, within the set of governments \mathcal{P} , the preferences of median government \tilde{p} represents the market's overall ideal point. To the extent that governments generally prefer professional bureaucrats (Miller and Whitford 2016), professional norms and standards of practice approximate this market ideal point. In this sense, professions function as “shadow principals” (Adolph 2013), and ambitious bureaucrats who pursue policies that converge toward the \tilde{p} will gain favorable professional reputations (Teodoro 2011). As we will see, these distributions affect principals' and agents' strategic behavior.

Assumption 3: complete market information. *Governments and bureaucrats have complete information about the labor market.* Governments know the properties of the aggregate supply of bureaucratic agents \mathcal{A} , including the distribution of ambition and skill Ω_a . Similarly, bureaucrats know the aggregate demand among governments \mathcal{P} , including the distribution of policy preferences and leniency Ω_p . All actors know current labor market conditions—that is, the relative status of different jobs, prevailing wages, and so on. However, both governments and bureaucrats face uncertainty about their specific counterparts in important respects, as we discuss below.

Assumption 4: principal-agent information problems are bilateral. *Individual governments and bureaucrats have incomplete information about each other.* The properties of any individual bureaucrat $a \in \mathcal{A}$ are only partially observable. Consequently, governments are never certain of a 's true ambition and skill level. These uncertainties underlie the classic “adverse selection” problem under PAT. Additionally, following job formation, the bureaucrat's behavior is only partially observable

and so government p faces uncertainty about the decisions of bureaucrat a . This uncertainty causes PAT's agency moral hazard problem.

In the same way, the properties of any individual government $p \in P$ are only partially observable to bureaucrats, and so bureaucrats are never certain about p 's true policy preferences and leniency. For this reason, agents also face an adverse selection problem: a bureaucrat may accept a job with government p expecting a certain policy mandate, when p in fact has quite different preferences. Bureaucrats may also be uncertain of their governments' on-the-job behavior, since governments may monitor their bureaucrats in ways that the latter cannot observe or anticipate. Governments may tend to over-monitor their bureaucrats, causing the "principal's moral hazard" (Miller and Whitford 2007).

Bureaucrats and governments may seek additional information about their counterparts pursuant to job formation and on-the-job behavior, but complete certainty is impossible.

Assumption 5: transaction costs. *Job formation and exit are costly.* For governments, the process of searching for, recruiting, and investigating candidates for bureaucratic jobs is costly. Exit from a job is also costly for governments because they must forego valuable services during any period of job vacancy. Regulatory and legal constraints (e.g., civil service laws) may affect the direct cost of job exit for a government.

For bureaucrats, the costs of job formation include resources spent searching for a job, investigating prospective employers, interviewing, and so on. Bureaucrats may seek costly education, accreditation, and/or licensure pursuant to employment. A bureaucrat's costs of job exit include any income foregone during a gap in employment. If a job change requires a significant geographic move or disruption to personal life, then bureaucrats bear those costs as well.

The logic of the model

As is common under PAT, we present LMT as a sequential, two-player game. Critically,

however, our model is truly bilateral insofar as either the principal or agent may initiate play by offering to form a job with a counterpart and end play by exiting the job.

Setup. The LMT game describes the job formation and dissolution process among heterogeneous pools of principals and agents. Once in a job, agents are charged with implementing policy, and they may either set policy that is consistent or inconsistent with the preference of the principal. For the sake of simplicity, policy is modeled as a dichotomy: an agent either implements a policy that is consistent with professional norms or is not consistent with professional norms. Professions are themselves labor market phenomena that create and sustain careers for expertise (Abbott 1988; Brint 1996). For the purposes of the model, professional policy coincides with the median preference among the pool of principals that an ambitious agent may wish to work for in the future. That is, professional policies are those favored by most higher-status governments. Since an agent's behavior while working for one principal will affect the agent's future job opportunities with other principals, we are concerned with whether or not an agent will set policy in a way that maximizes such future opportunities. Thus, when we say that a policy is *convergent* with professional norms, we mean that the policy is consistent with the market median among principals that an ambitious employee may hope to work for in the future (Dewatripont, Jewitt and Tirole 1999; Teodoro 2011).

There are heterogeneous pools of principals and agents. Each principal is engaged in an infinitely repeated game while each agent plays the game for only two time periods (after which the agent retires). Principals vary on two dimensions, shown in the top panel of Figure 1. First, each principal's policy preferences are either Convergent (C) with professional norms (i.e., favored by most other principals) or non-convergent (\sim C). Second, among principals with non-convergent preferences, there are those who are Lenient (L) towards agents who set convergent (i.e., professional) policies and those who are not lenient (\sim L). Agents also vary along two dimensions,

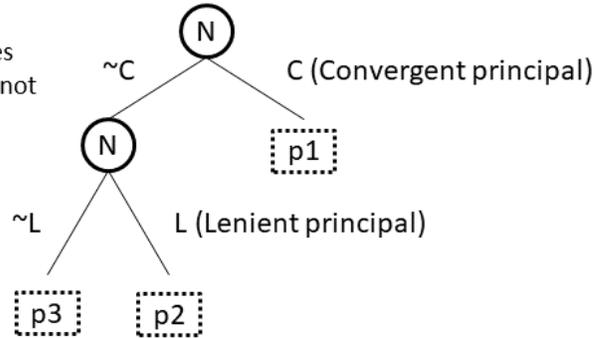
shown in the bottom panel of Figure 1. Some agents are relatively Skilled (S) while other agents are relatively unskilled ($\sim S$). Among the skilled agents, there are those who are ambitious (α) and those who are not ambitious ($\sim\alpha$).

Figure 1. Principal and agent types.

3 Principal Types

During interview, agent observes policy preference (C or $\sim C$) but not leniency (L or $\sim L$).

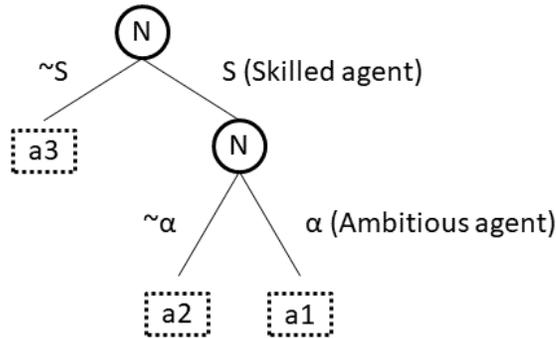
	L	$\sim L$
C	p1	
$\sim C$	p2	p3



3 Agent Types

During interview, principal observes skill level (S or $\sim S$) but not ambition (α or $\sim\alpha$).

	α	$\sim\alpha$
S	a1	a2
$\sim S$	a3	

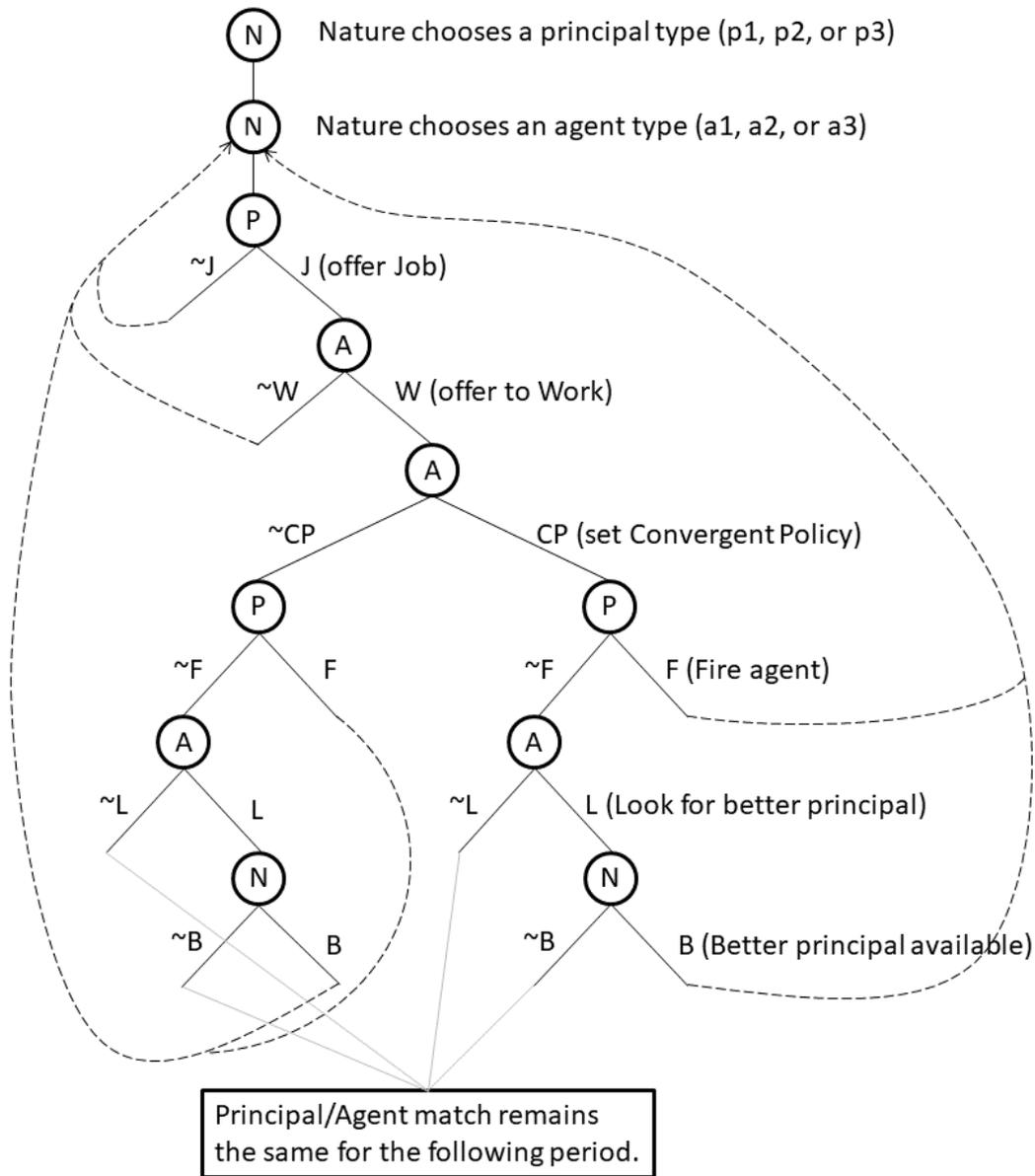


Principal's play. Figure 2 shows the sequence of moves for the LMT game from the perspective of the principal. Nature determines each principal's type by random draw from a probability distribution $\Omega_p = [\Pr(p1), \Pr(p2), \Pr(p3)]$. The principal is matched with an agent also drawn at random from the distribution $\Omega_a = [\Pr(a1), \Pr(a2), \Pr(a3)]$ for an interview.⁸ The principal must bear a cost of search ($\Gamma_{P-\sigma}$) each time it interviews an agent. During the interview the principal

⁸ By "interview," we mean all activities related to the principal's potential hiring of an agent. These might include review of application materials, background checks, and so on.

learns whether the agent is skilled or unskilled but does not learn whether the agent is ambitious or non-ambitious. Thus, the principal must use incomplete information when deciding whether or not to offer a job to the agent.

Figure 2. Sequence of game from principal's perspective



If the principal offers a job to the agent, the agent must choose whether or not to accept that position (offer to work). If the principal declines to offer the job or the agent declines the offer, the

principal is randomly matched with another agent. In this case, the principal must again bear search costs and then decide whether or not to offer new candidate a job. This interview process repeats until the principal offers the job to an agent and the agent offers to work.

Once a job is formed, the agent makes a policy decision. The agent may either set a convergent (i.e., professional) policy or a non-convergent policy. The principal receives a payoff that depends on both the skill level of the agent and the policy set by the agent. If the agent is unskilled ($\sim S$) and does not set the policy that the principal prefers, the principal receives the lowest possible payoff, which is normalized to 0.⁹ If the agent is unskilled ($\sim S$) and sets the principal's preferred policy, the principal's payoff is β_{pj-PP} , a value that depends on the principal's type (j). If the agent is skilled (S) and sets a policy that the principal does not prefer, the principal receives the payoff β_{P-S} . Finally, if the principal is skilled (S) and sets the principal's preferred policy, the principal receives a payoff of $\beta_{pj-PP} + \beta_{P-S}$ (the value of which, again, depends on the principal's type).¹⁰

After the agent sets the policy, the principal may fire the agent. If the agent is not fired, the agent then has the option to look for a better principal. If the agent looks for a better principal, nature randomly determines whether or not a better principal is available based on the probability distribution Ω_p . If the agent is fired or the agent looks for a better principal and a better principal is available, the principal must bear an exit cost (Γ_{P-E}) and then return to the interview stage of the game in the following period. Otherwise, the job match remains intact for one more period. When the job remains intact, the principal receives the same payoff as in the prior period but does not pay any search costs. An agent and principal can work together for at most two periods, after which the

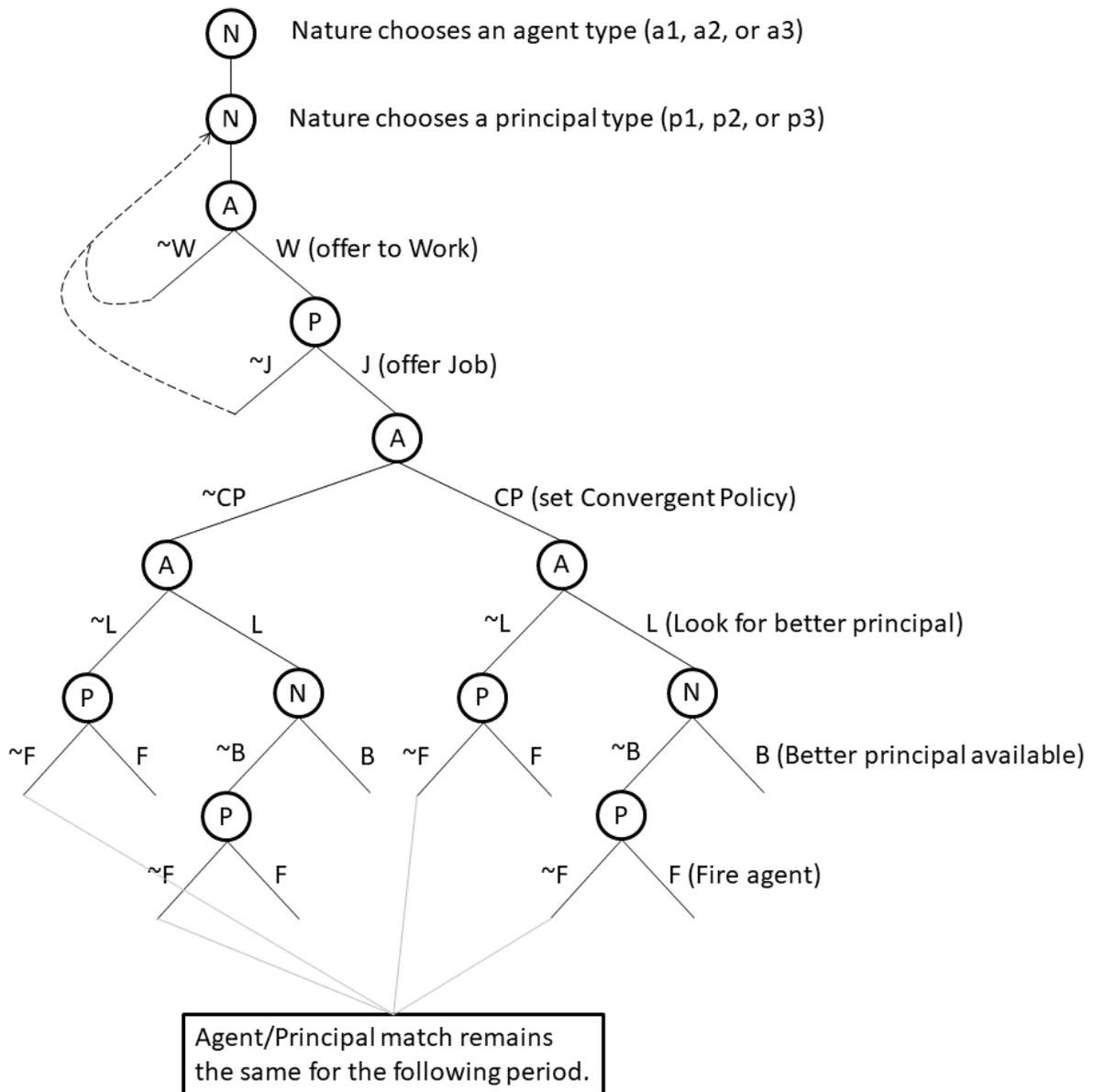
⁹ The choice of zero is arbitrary; the game will produce the same results if this payoff is set to any value that is both smaller than β_{P-S} and smaller than β_{p2-PP} .

¹⁰ This presentation implies that returns from skill and policy do not interact (are additive), but identical results can be obtained with other functional forms. All that matters for the results of the game is that the relative distances among the three sets of payoffs are identical to what we present.

principal returns to the interview stage of the game. This process repeats itself infinitely.

Agent's play. Figure 3 illustrates the game from the agent's perspective. Note that the order of some of the moves is depicted differently from Figure 2. The mathematical solution to the game is the same regardless the ordering of moves, but we depart from typical PAT models by recognizing that both principal and agent can be first-movers.

Figure 3. Sequence of game from agent's perspective



For the agent, the LMT game begins with nature choosing the agent's type from the population probability distribution Ω_a . The agent is then randomly matched with a principal for an interview, whose type is chosen from distribution Ω_p by nature. Like the principal, the agent must bear a search cost ($\Gamma_{A-\sigma}$) for each interview, and the agent has incomplete information. During the interview the agent observes whether the principal prefers convergent (professional) policy or non-convergent (non-professional) policy, but the agent cannot observe whether or not the principal is lenient. The agent decides whether or not to offer to work, and the principal can decide whether or not to accept an agent's offer. If the agent does not offer to work or the principal does not offer employment, the agent continues interviewing until a job is formed. Once a job is formed, the agent chooses a policy (either convergent or non-convergent). Regardless of the policy chosen, the agent receives a fixed payoff from holding the job (ρ_{A-J}).

The agent then chooses whether or not to look for a better principal. Looking for a better principal requires that the agent once again bear the cost of search ($\Gamma_{A-\sigma}$).¹¹ If the agent looks for a better principal, nature determines whether or not a better principal is available. If the agent is unskilled and/or the agent set a non-convergent policy, a better principal will not be available. If the agent is skilled and the agent set a convergent policy, there is probability $\Pr(BP)$ that a better principal is available. If a better principal is available, the existing job ends, and in the following period the agent bears the cost of exit (Γ_{A-E}) and also receives a payoff of ρ_{A-BP} . If a better principal is not available or the agent decides not to look for a better principal, the principal in the existing relationship chooses whether or not to fire the agent. If the agent is not fired, the principal and agent remain in the same job for the following period, and the agent receives the same payoff in its second period as she received in the first period (ρ_{A-J}). If the principal fires the agent, the agent

¹¹ The agent bears this search cost in the first period because the agent is searching for a better principal while still working for its current principal.

receives a payoff of ρ_{A-F} in the following period. As noted above, agents only play the game for two periods.

Table 1. Key to symbols used in the game

$\Pr(pj)$: Probability of nature choosing principal j
$\Pr(aj)$: Probability of nature choosing agent j
$\Pr(BP)$: Probability of nature choosing that a better principal is available (for a skilled agent who sets a convergent policy)
$\Pr(\sim BP)$: Probability of nature choosing that a better principal is not available (for a skilled agent who sets a convergent policy)
$\Gamma_{A-\sigma}$: Cost to the agent of searching for (interviewing) a new principal
$\Gamma_{P-\sigma}$: Cost to the principal of searching for (interviewing) a new agent
Γ_{A-E} : Cost to the agent of exiting the relationship with their current principal
Γ_{P-E} : Cost to the principal of exiting the relationship with their current agent
δ_p : Discount rate for principal
δ_{aj} : Discount rate for agent j
β_{pj-pp} : Benefit to principal j of having the agent set the principal's preferred policy
β_{p-s} : Benefit to the principal of having a skilled agent
ρ_{A-j} : payoff to agent of a job (with any principal playing the game)
ρ_{A-BP} : payoff to the agent of working for a better principal
ρ_{A-F} : payoff to the agent of being fired (when a better principal is not available)
C: principal prefers Convergent policy
J: principal offers Job to agent
F: principal Fires agent
S: agent is Skilled
W: agent offers to Work for principal
CP: agent sets Convergent Policy
L: agents Looks for better principal

Mathematical assumptions. We make some basic mathematical assumptions. Table 1 provides a key of the symbols we use to express our game. The probabilities for the various principal and agent types (and for the two potential outcomes of looking for a better principal) sum to 1, and are bounded between zero and one. The principal's discount rate factor is also bounded between

zero and one.¹² The costs of search and exit for the principal and agent are greater than zero, and the discount rate factors of the agents are greater than zero, so that:

$$\Pr(p1) + \Pr(p2) + \Pr(p3) = \Pr(a1) + \Pr(a2) + \Pr(a3) = \Pr(BJ) + \Pr(\sim BJ) = 1$$

$$0 < \Pr(p1), \Pr(p2), \Pr(p3), \Pr(a1), \Pr(a2), \Pr(a3), \Pr(BJ), \Pr(\sim BJ), \delta_p < 1$$

$$\Gamma_{P-\sigma}, \Gamma_{P-E}, \Gamma_{A-\sigma}, \Gamma_{A-E}, \delta_{a1}, \delta_{a2}, \delta_{a3} > 0$$

Regardless of principal type, the benefit associated with having an agent who sets the preferred policy or an agent who is skilled is positive:

$$\beta_{p1-PP}, \beta_{p2-PP}, \beta_{p3-PP}, \beta_{P-S} > 0$$

The lenient principal (*p2*) has payoffs such that a strategy involving firing agents is never optimal. More precisely, a strategy requiring the principal to fire agents who set convergent policy is always dominated by a strategy that does not require firing agent:

$$\beta_{p2-PP} < \frac{\Gamma_{P-\sigma} + \Gamma_{P-E}[\Pr(a1) + \Pr(a2)]}{\Pr(a2)(1 + \delta_p)}$$

$$\beta_{p2-PP} < \frac{\beta_{P-S} \Pr(a3)(1 + \delta_p) + \Gamma_{P-\sigma} + \Gamma_{P-E}}{[\Pr(a2) + \Pr(a3)](1 + \delta_p)}$$

The non-lenient principal (*p3*) has payoffs such that firing agents can be an optimal strategy. For the non-lenient principal (*p3*), the difference between the utility derived from a skilled agent who sets non-convergent policy and the utility derived from a skilled agent who sets convergent policy is greater than for the lenient principal (*p3*):

$$\beta_{p3-PP} > \frac{\Gamma_{P-\sigma} + \Gamma_{P-E}[\Pr(a1) + \Pr(a2)]}{\Pr(a2)(1 + \delta_p)}$$

$$\beta_{p3-PP} > \frac{\beta_{P-S} \Pr(a3)(1 + \delta_p) + \Gamma_{P-\sigma} + \Gamma_{P-E}}{[\Pr(a2) + \Pr(a3)](1 + \delta_p)}$$

¹² In conventional game theory notation, the “discount rate factor” δ is $(1-r)$, where r is a discount rate. Consequently, a low discount rate r implies a high discount rate factor δ , and vice versa.

For agents, working a job (ρ_{A-J}) provides a higher payoff than being fired (ρ_{A-F}):

$$\rho_{A-J} > \rho_{A-F}$$

Ambitious agents have a discount rate factor (δ_{a1}) high enough that they are willing to accept the cost of searching for a new job ($\Gamma_{A-\sigma}$) in order to reap the potential future benefits of a better principal (ρ_{A-BP}). Non-ambitious agents, on the other hand, have a discount rate factor (δ_{a2}) low enough that they are not willing to bear this cost.

$$\delta_{a1} > \frac{\Gamma_{A-\sigma}}{(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J})\Pr(BP)}$$

$$\delta_{a2} < \frac{\Gamma_{A-\sigma}}{(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J})\Pr(BP)}$$

Equilibrium behavior under Labor Market Theory

Many different equilibria are possible, depending on the values of the parameters of the game. Our description here focuses on the logic of each player's behavior under some equilibria that correspond to common but poorly understood situations in bureaucratic politics, and then provide some intuition regarding the results. More details regarding which equilibria are possible under various sets of parameters are shown in the appendix. In some cases, multiple equilibria exist under the same set of parameters; thus, the equilibrium behavior of one player depends upon which equilibrium strategy is adopted by the other player. All games are bilateral; we begin by presenting the logic of the principals and then turn to equilibrium strategies for agents.

Principals

Different types of principals yield different equilibrium strategies.

Principals with convergent policy preferences ($p1$). The equilibrium behavior of $p1$ is exogenous to the specific strategies adopted by the other players; that is, the equilibrium behavior of $p1$ can be determined purely based on the parameters of the game. We do not identify the parameter

values that would lead to differences in the strategy of firing versus not firing for non-convergent policy ($F|\sim CP$ vs. $\sim F|\sim CP$) for $p1$ since this move is always off the equilibrium path and will never affect any agent's behavior as long as we assume that an agent who is indifferent between policy options (either strategy yields an equal expected utility) will choose the principal's preferred policy.

If $\beta_{P-S} < \Gamma_{P-E} \frac{\Pr(a1)\Pr(Bj)\delta_p}{\Pr(a1)[1+\Pr(\sim BJ)\delta_p]+\Pr(a2)(1+\delta_p)} - \Gamma_{P-\sigma} \frac{1}{\Pr(a3)(1+\delta_p)}$: the equilibrium

strategy for $p1$ is ($\sim J|S, J|\sim S; \sim F|CP, F|\sim CP$) - (Scenario D or E for the $a1$).

If $\beta_{P-S} > \Gamma_{P-E} \frac{\Pr(a1)\Pr(Bj)\delta_p}{\Pr(a1)[1+\Pr(\sim BJ)\delta_p]+\Pr(a2)(1+\delta_p)} +$

$\Gamma_{P-\sigma} \frac{1}{\Pr(a1)[1+\Pr(\sim BJ)\delta_p]+\Pr(a2)(1+\delta_p)}$: the equilibrium strategy for $p1$ is ($J|S, \sim J|\sim S;$

$\sim F|CP, F|\sim CP$) - (Scenario A, B, or C for the $a1$).

Otherwise: the equilibrium strategy for $p1$ is ($J|S, J|\sim S; \sim F|CP, F|\sim CP$) - (Scenario A, B, or C for the $a1$).

Principals who prefer professional policy ($p1$) are convergent with the market's median buyer, and so need not fear that a skilled, ambitious agent will set policy inconsistent with the principal's preferences; put another way, $p1$ faces no loyalty-competence tradeoff. These principals will always prefer to hire skilled agents, and will hire unskilled agents only if the cost of exit is high relative to the premium placed on skill. If the costs of searching for another agent are high enough, $p1$ will be willing to hire any agent; otherwise, they will hold out for either a skilled agent (if the premium placed on skill is large enough relative to the cost of exit) or an unskilled agent (if the cost of exit is sufficiently large). In this scenario, agents act in accordance with professional norms and will never set non-convergent policy for $p1$ in equilibrium.

Lenient principals with non-convergent policy preferences ($p2$). The equilibrium strategy for $p2$ depends on the play of the skilled, ambitious agents ($a1$).

Scenario 1. if $a1$ plays ($W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C$):

$$\text{If } \beta_{p2-PP} < \beta_{P-S} \frac{\Pr(a1)[1+\Pr(\sim BJ)\delta_P] + \Pr(a2)(1+\delta_P)}{\Pr(a1)[1+\Pr(\sim BJ)\delta_P]} - \Gamma_{P-E} \frac{\Pr(BJ)\delta_P}{[1+\Pr(\sim BJ)\delta_P]} -$$

$\Gamma_{P-\sigma} \frac{1}{\Pr(a1)[1+\Pr(\sim BJ)\delta_P]}$: the equilibrium strategy for $p2$ is (J|S, $\sim J|\sim S$; $\sim F|CP$,

$\sim F|\sim CP$) - (Scenario A, B, or D for the $a1$).

$$\text{If } \beta_{p2-PP} > \beta_{P-S} \frac{\Pr(a1)[1+\Pr(\sim BJ)\delta_P] + \Pr(a2)(1+\delta_P)}{\Pr(a1)[1+\Pr(\sim BJ)\delta_P]} - \Gamma_{P-E} \frac{\Pr(BJ)\delta_P}{[1+\Pr(\sim BJ)\delta_P]} +$$

$\Gamma_{P-\sigma} \frac{\Pr(a1)[1+\Pr(\sim BJ)\delta_P] + \Pr(a2)(1+\delta_P)}{\Pr(a1)\Pr(a3)(1+\delta_P)[1+\Pr(\sim BJ)\delta_P]}$: the equilibrium strategy for $p2$ is ($\sim J|S$, J| $\sim S$;

$\sim F|CP$, $\sim F|\sim CP$) - (Scenario C or E for the $a1$).

Otherwise: the equilibrium strategy for $p2$ is (J|S, J| $\sim S$; $\sim F|CP$, $\sim F|\sim CP$) -

(Scenario A, B, or D for the $a1$).

When ambitious agents ($a1$) always set convergent (professional) policy, a lenient principal with non-convergent policy preferences ($p2$) must account for the possibility that hiring a skilled agent will result in convergent, professional policy. Thus, $p2$ faces a loyalty-competence tradeoff. If both the premium associated with the preferred policy and the cost of exit are small enough (relative to the premium associated with having a skilled agent), $p2$ will prefer to offer the job only to skilled agents—meaning that competence is valued over loyalty. Conversely, if the principal places a sufficiently low premium on having a skilled agent, $p2$ will prefer unskilled agents; in this case, $p2$ values loyalty over competence. Again, if the costs of search are prohibitively high, $p2$ will offer the job to any agent. Because the principal is lenient, he will never fire an agent.

Scenario 2. if $a1$ plays (W|C, $\sim W|\sim C$; CP|C, CP| $\sim C$; L|C, L| $\sim C$):

If $\Gamma_{P-\sigma} < \beta_{P-S} \Pr(a2)(1 + \delta_P)$: the equilibrium strategy for $p2$ is (J|S,

$\sim J|\sim S$; $\sim F|CP$, $\sim F|\sim CP$) - (Scenario A, B, or D for the $a1$).

Otherwise: the equilibrium strategy for $p2$ is (J|S, J| $\sim S$; $\sim F|CP$, $\sim F|\sim CP$) -

(Scenario A, B, or D for the $a1$).

In this scenario an ambitious agent will not risk her reputation by contravening her professional norms. When ambitious agents refuse to work for principals with non-convergent policy preferences, there is no possibility that an agent will leave after one period or set convergent policy for a principal that prefers non-convergent policy. Thus, skilled agents always provide a better payoff to p_2 than unskilled agents. Principals of type p_2 will hire only skilled agents as long as the cost of continuing the job search is sufficiently low. If the cost of search is prohibitively high, p_2 will be willing to hire any agent.

Scenario 3. if a_1 plays (W|C, W|~C; CP|C, ~CP|~C; L|C, ~L|~C):

If $\Gamma_{P-\sigma} < \beta_{P-S}[\Pr(a_1) + \Pr(a_2)](1 + \delta_P)$: the equilibrium strategy for p_2 is (J|S, ~J|~S; ~F|CP, ~F|~CP) - (Scenario A, B, or D for the a_1).

Otherwise: the equilibrium strategy for p_2 is (J|S, J|~S; ~F|CP, ~F|~CP) - (Scenario A, B, or D for the a_1).

If ambitious agents set non-convergent policy for principals who prefer non-convergent policy, p_2 will always prefer skilled to unskilled agents. As in the second scenario, p_2 will offer employment only to skilled agents if the cost of search is low enough. Otherwise, p_2 will hire any agent.

Non-lenient principals with non-convergent policy preferences (p_3). The equilibrium strategy for p_3 also depends on the play of his skilled, ambitious agent (a_1).

Scenario 1. if a_1 plays (W|C, W|~C; CP|C, CP|~C; L|C, L|~C):

$$\text{If } \beta_{p_3-PP} < \beta_{P-S} \frac{\Pr(a_1) + \Pr(a_2)(1 + \delta_P)}{\Pr(a_1)} - \Gamma_{P-E} \delta_P - \Gamma_{P-\sigma} \frac{1}{\Pr(a_1)}: \text{ the}$$

equilibrium strategy for p_3 is (J|S, ~J|~S; F|CP, ~F|~CP) - (Scenario A or D for the a_1).

$$\text{If } \beta_{p_3-PP} > \beta_{P-S} \frac{\Pr(a_1) + \Pr(a_2)(1 + \delta_P)}{\Pr(a_1)} - \Gamma_{P-E} \delta_P + \Gamma_{P-\sigma} \frac{\Pr(a_1) + \Pr(a_2)(1 + \delta_P)}{\Pr(a_1) \Pr(a_3)(1 + \delta_P)}:$$

the equilibrium strategy for p_3 is (~J|S, J|~S; F|CP, ~F|~CP) - (Scenario B, C, or

E for the $a1$).

Otherwise: the equilibrium strategy for $p3$ is $(J|S, J|\sim S; F|CP, \sim F|\sim CP)$ -

(Scenario A or D for the $a1$).

The non-lenient principal ($p3$) will fire agents who set convergent policy consistent with professional principles and in defiance of the political principal ($p3$). If the premium associated with the principal's preferred policy and the cost of exit are sufficiently small (relative to the premium of having a skilled agent), $p3$ will offer the job only to skilled agents. The non-lenient principal does this knowing that a skilled agent may be ambitious and thus set policy consistent with professional norms, contravening $p3$'s preferences. If the premium associated with having a skilled agent is low enough, $p3$ will prefer to hire unskilled agents. That is, facing a competence-loyalty tradeoff, the $p3$ prefers loyalty over competence. Hiring only unskilled agents ensures that the adopted policy will always match the principal's preferences, so $p3$ will never actually fire an agent in equilibrium under this strategy. If search costs are sufficiently large, $p3$ will hire any agent.

Scenario 2. if $a1$ plays $(W|C, \sim W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$:

If $\Gamma_{p-\sigma} < \beta_{p-s} \Pr(a2) (1 + \delta_p)$: the equilibrium strategy for $p3$ is $(J|S, \sim J|\sim S; F|CP, \sim F|\sim CP)$ - (Scenario A or D for the $a1$).

Otherwise: the equilibrium strategy for $p3$ is $(J|S, J|\sim S; F|CP, \sim F|\sim CP)$ -

(Scenario A or D for the $a1$).

Because ambitious agents refuse to work for principals with non-convergent policy preferences under this scenario, policy will always be set consistent with the principal's preference and agents will always stay for a second period. Thus, $p3$ will never fire an agent in equilibrium, and a skilled worker is always preferred to an unskilled worker. If the cost of searching for an agent is sufficiently low, $p3$ will only hire skilled workers. Otherwise, $p3$ will hire any agent who is willing to take the job.

Scenario 3. if $a1$ plays $(W|C, W|\sim C; CP|C, \sim CP|\sim C; L|C, \sim L|\sim C)$:

If $\Gamma_{p-\sigma} < \beta_{p-s}[\Pr(a1) + \Pr(a2)](1 + \delta_p)$: the equilibrium strategy for $p3$ is $(J|S, \sim J|\sim S; F|CP, \sim F|\sim CP)$ - (Scenario A or D for the $a1$).

Otherwise: the equilibrium strategy for $p3$ is $(J|S, J|\sim S; F|CP, \sim F|\sim CP)$ - (Scenario A or D for the $a1$).

Since ambitious agents will set policy to match the preferences of the principal in this scenario (and thus will never leave for another principal), skilled agents will always provide the principal a higher payoff than unskilled agents. As in Scenario 2, $p3$ will never fire an agent in equilibrium, and $p3$ will hire only skilled agents if the cost of search is low enough. If the cost of search is large enough, $p3$ will offer the job to any agent.

Agents

We now recapitulate the model from the agent's perspective. The agent's equilibrium strategy varies according to her skill, her ambition, and/or the principal's play.

Ambitious agents (a1). For ambitious agents, the equilibrium strategy depends on the principal's play.

Scenario A. If (1) $p1$ plays $(J|S, J|\sim S; \sim F|CP, F|\sim CP)$ or $(J|S, \sim J|\sim S; \sim F|CP, F|\sim CP)$; and (2) $p2$ plays $(J|S, J|\sim S; \sim F|CP, \sim F|\sim CP)$ or $(J|S, \sim J|\sim S; \sim F|CP, \sim F|\sim CP)$; and (3) $p3$ plays $(J|S, J|\sim S; F|CP, \sim F|\sim CP)$ or $(J|S, \sim J|\sim S; F|CP, \sim F|\sim CP)$:

If

$$\delta_{a1}(\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) \frac{\Pr(p1) \Pr(p3) \Pr(\sim BJ)}{[\Pr(p2) + \Pr(p3)]} < \Gamma_{A-\sigma}$$

$$< \delta_{a1}(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(BJ) - \delta_{a1}(\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) \frac{\Pr(p3) \Pr(\sim BJ)}{\Pr(p2) + \Pr(p3)}$$

: the equilibrium strategy for $a1$ is $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ -

(Scenario 1 for the $p2$ and $p3$).

If

$$\Gamma_{A-\sigma} < \delta_{a1} \frac{1}{[1 + \Pr(a1)][\Pr(p2) + \Pr(p3)]} \\ \times \min\{(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(p1) [\Pr(p2) + \Pr(p3)] \Pr(BJ), (\rho_{A-J} - \rho_{A-F} \\ + \Gamma_{A-E}) \Pr(p1) [1 + \Pr(a1)] \Pr(p3) \Pr(\sim BJ)\}$$

: the equilibrium strategy for $a1$ is (W|C, \sim W| \sim C; CP|C, CP| \sim C; L|C, L| \sim C) -

(Scenario 2 for the $p2$ and $p3$).

Otherwise: the equilibrium strategy for $a1$ is (W|C, W| \sim C; CP|C, \sim CP| \sim C; L|C,

\sim L| \sim C) - (Scenario 3 for the $p2$ and $p3$).

When all three principal types are willing to hire skilled agents, ambitious agents will choose one of three strategies depending on the game's parameters. If the potential benefits of finding a better principal outweigh the risk of being fired by a non-lenient principal and search costs are large enough to discourage the agent from accepting offers only from principals with professionally convergent preferences, $a1$ will work for any principal, always set professionally convergent policy, and look for a new principal. If search costs are small enough relative to the probability of selecting a principal with convergent policy preferences ($p1$), $a1$ will work only for principals with convergent policy preferences. If neither of the other strategies is dominant, the agent will work for any principal but will only set professionally convergent policy when working for a principal who prefers it.

Scenario B. If (1) $p1$ plays (J|S, J| \sim S; \sim F|CP, F| \sim CP) or (J|S, \sim J| \sim S;

\sim F|CP, F| \sim CP); and (2) $p2$ plays (J|S, J| \sim S; \sim F|CP, \sim F| \sim CP) or (J|S, \sim J| \sim S;

\sim F|CP, \sim F| \sim CP); and (3) $p3$ plays (\sim J|S, J| \sim S; F|CP, \sim F| \sim CP): the equilibrium

strategy for $a1$ is (W|C, W| \sim C; CP|C, CP| \sim C; L|C, L| \sim C) - (Scenario 1 for $p2$ and

$p3$).

When non-lenient principals ($p3$) refuse to offer positions to skilled agents, ambitious agents can accept work from any principals who will offer them work and set policy convergent with

professional norms without fear of being fired. Ambitious agents will always set professionally-sanctioned policies and look for a better principal under these conditions.

Scenario C. If (1) $p1$ plays $(J|S, J|\sim S; \sim F|CP, F|\sim CP)$ or $(J|S, \sim J|\sim S; \sim F|CP, F|\sim CP)$; and (2) $p2$ plays $(\sim J|S, J|\sim S; \sim F|CP, \sim F|\sim CP)$; and (3) $p3$ plays $(\sim J|S, J|\sim S; F|CP, \sim F|\sim CP)$:

Agent $a1$ must be playing $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ - (Scenario 1 for $p2$ and $p3$) in order for this combination of principal strategies to be possible in equilibrium. Multiple strategies offer equal expected utility to $a1$, but depending on the agent's beliefs, different ranges of parameter values will make $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ the dominant strategy.

Here, all principals with non-professionally convergent policy preferences are unwilling to hire a skilled agent. The ambitious agent ($a1$), then, must work for principals with convergent policy preferences. How $a1$ behaves off the equilibrium path (when faced with a principal with convergent policy preferences) will not affect the agent's expected utility. But if principals with non-professionally convergent policy preferences are passing over the skilled agents in an equilibrium, it must be the case that the ambitious agent ($a1$) is playing a strategy that requires setting professionally convergent policy even if doing so clashes with the preferences of her employer.

Scenario D. If (1) $p1$ plays $(\sim J|S, J|\sim S; \sim F|CP, F|\sim CP)$; and (2) $p2$ plays $(J|S, J|\sim S; \sim F|CP, \sim F|\sim CP)$ or $(J|S, \sim J|\sim S; \sim F|CP, \sim F|\sim CP)$; and (3) $p3$ plays $(J|S, J|\sim S; F|CP, \sim F|\sim CP)$ or $(J|S, \sim J|\sim S; F|CP, \sim F|\sim CP)$:

If $\Gamma_{A-\sigma} < \delta_{a1} \left[(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(BJ) - (\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) \Pr(\sim BJ) \frac{\Pr(p3)}{\Pr(p2)+\Pr(p3)} \right]$: the equilibrium strategy for $a1$ is $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ - (Scenario 1 for the $p2$ and $p3$).

Otherwise: the equilibrium strategy for $a1$ is $(W|C, W|\sim C; CP|C, \sim CP|\sim C; L|C, \sim L|\sim C)$ - (Scenario 3 for the $p2$ and $p3$).

When both $p2$ and $p3$ are willing to hire skilled workers, the ambitious agent must account for the possibility that a principal with non-convergent policy preferences may be non-lenient. As such, $a1$ will set convergent policy against the wishes of a principal and look for a better principal if the payoff associated with obtaining a job with a better principal (weighted by the probability of finding a better job) is large enough relative to the loss associated with being fired (weighted by the probability of being fired).

Scenario E. If (1) $p1$ plays $(\sim J|S, J|\sim S; \sim F|CP, F|\sim CP)$; and (2) $p2$ plays $(\sim J|S, J|\sim S; \sim F|CP, \sim F|\sim CP)$; and (3) $p3$ plays $(\sim J|S, J|\sim S; F|CP, \sim F|\sim CP)$:

Agent $a1$ must be playing $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ - (Scenario 1 for $p2$ and $p3$) in order for this combination of principal strategies to be possible in equilibrium. All strategies offer equal $(-\infty)$ expected utility to $a1$, but depending on the agent's beliefs, different ranges of parameter values will make $(W|C, W|\sim C; CP|C, CP|\sim C; L|C, L|\sim C)$ the dominant strategy.

When all principals refuse to offer positions to skilled agents, ambitious agents cannot find work no matter what strategy they adopt. This situation only comes about in equilibrium if the agent is unable to credibly commit (based on her beliefs and payoffs) to setting non-professionally convergent policy (off the equilibrium path) for a principal with non-convergent preferences.

Non-ambitious and unskilled agents ($a2$ and $a3$). The equilibrium strategy for both non-ambitious ($a2$) and unskilled ($a3$) agents is the same, regardless of the principal's play: $(W|C, W|\sim C; CP|C, \sim CP|\sim C; \sim L|C, \sim L|\sim C)$.

Agents who are not skilled and/or ambitious ($a2, a3$) will work for any principal, will always set policy that is consistent with their principals' preferences, and will never seek a better principal.

These agents populate canonical PAT models.

Discussion

The model advanced here applies to any context where governments participate in reasonably liberal labor markets, and generates explanations for politicians' and bureaucrats' behaviors alike. Here we present a series of hypotheses that follow from the equilibria developed earlier. The list offered here is not exhaustive; LMT might generate more hypotheses with a modicum of creativity. Our present aim is to highlight hypotheses that fall outside the scope of existing theories. The familiar "all else equal" caveat applies to each of the hypotheses that follows.

Hypotheses about job formation

The first hypotheses concern politicians and their hiring decisions:

H1.1 Hiring less skilled agents. A principal hires less skilled agents when the principal has non-professional policy preferences, skilled agents are likely to be ambitious, and the principal sets a higher premium on policy than on skill.

H1.2 The principal's exit costs. As a principal's costs of job exit increase, the likelihood that (s)he hires a less skilled agent increases.

H1.3 The principal's search costs. A principal hires agents of any skill level when the principal's search costs are sufficiently high.

H1.4 Hiring skilled agents. A principal hires only skilled agents when (s)he has professional policy preferences or places a low premium on policy, the premium on skill is high relative to the cost of exit, and skilled agents are unlikely to be ambitious.

In our model, principals intentionally hire unskilled agents for one of three reasons: (1) unskilled agents set the desired policy, (2) unskilled agents are more stable, or (3) it is too expensive to find a skilled agent. Hypothesis H1.1 reflects the familiar competence-loyalty tradeoff, but identifies conditions under which politicians are likely to hire less skilled bureaucrats due to labor market considerations, not simply for their loyalty or for patronage purposes. Hypotheses H1.2-3 link a principal's transaction costs to his hiring decisions: high exit costs cause the principal to hire less

skilled agents because they are more stable, while high search costs cause principals to hire indiscriminately. Hypothesis H1.4 identifies conditions under which politicians will opt for skilled bureaucrats, even when there is a substantial risk that the bureaucrat will exit. One surprising implication is that transaction costs reduce or eliminate the over-monitoring that Miller and Whitford (2007) have called the “principal’s moral hazard”: the principal foregoes monitoring and simply accepts whatever choices the agent makes.¹³ Also striking about hypothesis H1.4 is the narrow combination of conditions that must hold in order for a principal to prefer a highly skilled agent. Together these hypotheses complement research on appointments by explaining why governments so often hire less skilled bureaucrats and, as importantly, why governments sometimes opt for skilled bureaucrats.

A signal feature of LMT is its bilateralism, and so we also derive hypotheses about bureaucrats’ decisions to offer work or accept jobs.

H2.1 Indiscriminate agents. Less skilled and/or non-ambitious agents work for any principal.

H2.2 Selective agents. Skilled, ambitious agents work only for principals who prefer professional policies when it is inexpensive for the agent to find such principals and there is a credible threat of being fired.

H2.3 Job satisficing. Skilled, ambitious agents work for a principal with non-professional policy preferences when it is expensive for the agent to find a principal with professional preferences OR principals with professional preferences have high exit costs OR there is no credible threat of being fired.

With its less skilled and/or non-ambitious agents who are willing to work for any principal, H2.1

¹³ This aspect of LMT suggests that bureaucrats may achieve autonomy by raising governments’ costs of job formation and exit, through civil service requirements, job protections, professional accreditation, or licensure, for example. Raising transaction costs may be an especially fruitful strategy for less ambitious or less skilled bureaucrats who seek autonomy. Moe’s (2011) description of job protections for teachers under collective bargaining agreements offers an illustration: “Any administrators who attempt to dismiss a teacher are embarking on a process that is destined to be extremely costly and time-consuming... For administrators throughout the public school system, there is no point in even *trying* to get bad teachers out of the classroom” (185-6; italics in original). One implication of LMT is that in collective bargaining, school boards who are concerned about performance should offer higher pay linked to longevity—even if unconnected to performance—rather than agree to procedural constraints that hinder the removal of bad teachers.

depicts the undifferentiated agents typical of canonical PAT models. Hypotheses H2.2 and H2.3 refer to the skilled, ambitious bureaucrats who sometimes emerge as policy entrepreneurs (Schneider, Teske and Mintrom 1995; Carpenter 2001; Teodoro 2011) or paragons of professionalism (Miller and Whitford 2016). When the demand for their labor is strong, skilled and ambitious agents have low search costs because principals will seek them out, and these agents will accept jobs that allow them to build reputations pursuant to further promotions. On the other hand, H2.3 also suggests that when a skilled, ambitious bureaucrat faces a job market with low demand or surplus supply, she is likely to satisfice by working for a principal with non-convergent preferences.

Hypotheses about exit

Our LMT offers hypotheses about exit from jobs, too. Only one hypothesis about principal exit follows from the theory:

H3.1 Infrequent firings. Principals seldom sack agents, even if the agents set policies that contravene the principal's preferences or perform poorly.

This startling result follows because LMT predicts that principals and agents connect in bilateral relationships with knowledge of their counterparts' skill (agents) and policy preferences (principals). According to LMT, policy conflicts could occur only when a non-lenient principal who has non-convergent policy preferences is matched with a skilled and ambitious agent. LMT argues that such a principal would only wind up with a skilled, ambitious agent if the principal was hiring indiscriminately due to high search costs or if the principal cares enough about policy to fire an agent over policy but does not care so much that the principal is willing to accept an unskilled agent (who will always provide the principal's preferred policy). Consequently, policy conflicts between principal and agent are likely to be uncommon, and when they occur, simply imposed by the ambitious agent and accepted by the unhappy principal. By the same token, principals who select less skilled agents reasonably expect them to perform poorly and do not fire them when performance suffers. Taken together, the result is that principal exit from a job (i.e., firing) is

uncommon, and when it occurs it is likely due to a mistaken assessment of the prospective agent's ambition or when principals change following an election, for example.¹⁴

Our model also allows hypothesizing about the conditions under which bureaucrats resign.

H4.1 Rare resignation. Less skilled, non-ambitious agents seldom resign their jobs.

H4.2 Progressive quitting. Skilled agents who act professionally are more likely than agents who set non-professional policies to resign their jobs in order to accept jobs with different principals.

As before, hypothesis H4.1 approximates the agents who populate canonical PAT models, which preclude voluntary exit by the bureaucrat. Hypothesis H4.2 links bureaucratic ambition to policy decisions, and so explains why bureaucrats sometimes leave their jobs voluntarily.

Hypotheses about political behavior

Central to LMT is the idea that labor market conditions shape bureaucratic politics:

H5.1 Competition for labor. As the number and availability of attractive jobs (i.e., better principals), the principal's ability to influence the agent's behavior decreases.

Corollary 5.1: As demand for skilled bureaucratic labor increases, the likelihood that skilled, ambitious agents set professional policies against the wishes of non-convergent principals also increases.

H5.2 Bureaucratic ambition. As an agent's ambition increases, the principal's ability to influence the agent's behavior decreases.

Corollary 5.2: As an agent's ambition increases, the likelihood that (s)he sets professional policies against the wishes of non-convergent principals also increases.

H5.3 The agent's transaction costs. As the agent's costs of job exit and job search increase, the principal's ability to influence the agent's behavior also increases.

Corollary 5.3: As the agent's costs of job exit and job search increase, the likelihood that (s)he sets policies against the wishes of non-convergent principals decreases.

¹⁴ If Maranto and Wolf (2013) are correct, then LMT explains why Michelle Rhee (an *a1*) resigned as Washington, DC's school chancellor in 2010 following the election of mayor Vincent Gray (a *p3*).

In PAT terms, hypotheses H5.1-3 address the risk of the agent's moral hazard as a function of the labor market. Hypotheses H5.1-3 and their corollaries specify conditions under which agents might contravene their principals, making bureaucratic policy entrepreneurship more or less likely.

Notably, the variables that condition the principal-agent relationship in H5.1 and H5.2—the number and quality of other buyers and sellers in the market—are exogenous to the job. However, governments and bureaucrats can have some influence over bureaucrats' transaction costs. For example, bureaucrats in high demand might demand buyout or severance bonuses in order to raise the principal's cost of exit (Connolly 2017). Remuneration mechanisms that are tied to long service in a single agency (e.g., longevity bonuses, pensions with vesting provisions) raise the agent's cost of exit in a way that gives the principal leverage against moral hazard. This finding is counterintuitive because longevity-dependent benefits in are typically depicted as rents extracted by public employees (Bellante and Long 1981; Moe 2011). A LMT perspective suggests that, on the contrary, these “golden handcuffs” constrain agent job mobility in ways that help assure compliance with principals' preferences.

Limitations and possible extensions

As with any formal theory, LMT is an elegant depiction of a complicated political world. The theory adds considerable verisimilitude to existing PAT models, and joins bureaucentric theories in modeling bureaucrats as independent political actors in transactional relationships with politicians. Nonetheless, LMT is an abstraction. The model provides for many of the variables that condition the transactional relationships between bureaucrats and politicians, but important complicating factors are neglected here. Happily, LMT's basic framework can be modified or extended to accommodate additional variables or apply to specialized contexts. Here we identify a few clear avenues for development.

Non-government employers. The basic LMT model assumes that all buyers of

bureaucratic labor are government agencies. That assumption could be relaxed to include private sector employers as additional potential principals, as Adolph (2013), Gailmard and Patty (2007), and Prendergast (2007) do. A public/private binary could substitute for the lenient/non-lenient dimension of each principal, or as an additional dimension of analysis. This setup would allow rigorous modeling of the conditions under which public service motivation (Perry 1997) would be expected to condition bureaucratic politics for both principals and agents.

Patronage. The basic LMT assumes that principals gain utility from bureaucratic jobs through effective implementation of their favored policies. However, journalistic accounts and voluminous political science research indicate that politicians often gain significant utility by treating bureaucratic jobs as patronage to be distributed in exchange for electoral support (Johnston 1979; Lewis 2007). A simple modification to the basic LMT could allow the principal to weigh the patronage value of a job against its policy implementation value. Just so, LMT could be modified so that agents are more or less loyal to a party and so offer an agent-side complement research on models of the competence-loyalty tradeoff.

Pure policy motivation. The basic LMT's motivating variable for agents—career ambition—is intentionally narrow.¹⁵ Career ambition as a basic motivator has the advantages of simplicity, face validity, clarity and internal consistency. However, as articulated here, LMT it does not accommodate *zealots* in Downs' (1967) sense: true believers who fervently pursue policy goals for their own sake. Replacing or complementing the model's ambition assumption with an independent policy preference for the agent would allow analysis of how the job formation and exit

¹⁵ Career ambition as a basic motivation is not as restrictive as it might seem at first glance. For example, ambition can encompass concern for reputation (Carpenter and Krause 2012) or budget maximizing (Niskanen 1971). Ambition can even take in public service motivation insofar as career advancement (from, say, lieutenant to general in the Army, or from fire chief in Little Rock to fire chief in Atlanta) allows a bureaucrat to serve more people or with greater impact. An altruistic administrator cannot serve the public without a government agency to serve. The public service tango takes two.

processes facilitate or inhibit true zealotry in the bureaucracy. Such a modification might help specify more carefully the conditions under which “guerrilla bureaucrats” (O’Leary 2006) are likely to emerge, for example.

Oligopsony and monopsony. Our discussion of LMT presumes a reasonably large bureaucratic labor market on both the supply and demand sides; the job markets for law enforcement, education, health services, and environmental administration in the United States are suitable examples. However, many important public administration contexts may feature few government labor buyers—perhaps just one. For example, the markets for air traffic controllers and artillery officers in the US each effectively have just one public sector customer: the Federal Aviation Administration and Department of Defense, respectively. Exploration of LMT’s implications under oligopsony or monopsony conditions could yield important insights.

Conclusion

Heterogeneity, job mobility, and competitive labor markets are ubiquitous features of bureaucratic life that are too often absent from political scientists’ models. Placing these variables at the heart of a theory of bureaucratic politics makes labor market conditions paramount to understanding bureaucrats’ and politicians’ behavior. Heeding Carpenter and Krause’s (2014) call for study of the bureaucracy from a “transactional authority” perspective, LMT yields important insights about bureaucratic politics by analyzing the factors that follow from the labor market transactions that connect bureaucrats to governments.

Our theory advances and helps consolidate divergent theoretical traditions in the study of bureaucratic politics by simultaneously modeling the decisions of administrators and the governments that employ them. LMT improves upon existing principal-agent models by accounting for heterogeneity of preferences and characteristics among both bureaucrats and governments, and so provides firm microfoundations and greater verisimilitude. At the same time, LMT maintains

sufficient elegance and flexibility to allow adaptation and application of the model to a variety of contexts. LMT lends greater rigor to public administration theories by predicting when and how bureaucrats shape public policies pursuant to professionalism. Taking bureaucratic labor markets seriously offers new empirical and theoretical opportunities in both political science and public administration traditions, and perhaps a means of uniting them.

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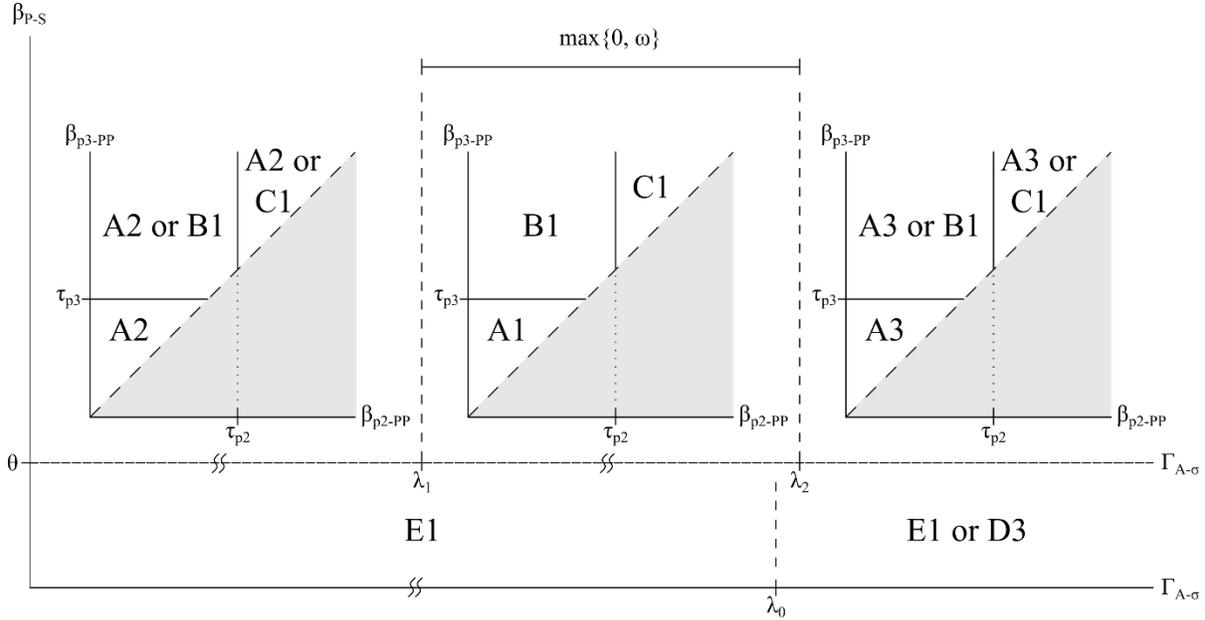
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Appendix

Figure A1. Equilibrium ranges



Behavior of principals with regards to skilled agents (a1)

A: all principals hire skilled agents

B: only lenient principals and principals with convergent policy preferences ($p1$ and $p2$) hire skilled agents

C: only principals with convergent policy preferences ($p1$) hire skilled agents

D: only principals with non-convergent policy preferences ($p2$ and $p3$) hire skilled agents

E: no principal will hire skilled agents

Behavior of skilled agents (a1)

1: ambitious agents ($a1$) work for any principal, always set convergent policy, and always look for a better job

2: ambitious agents ($a1$) only work for principals with convergent policy preferences ($p1$) and always looks for a better job.

3: ambitious agents ($a1$) work for any principal, set whatever policy the principal wants, and only look for a better job if working for principals with convergent policy preferences ($p1$)

$$\theta = \Gamma_{P-E} \frac{\Pr(a1) \Pr(Bj) \delta_p}{\Pr(a1) [1 + \Pr(\sim Bj) \delta_p] + \Pr(a2) (1 + \delta_p)} - \Gamma_{P-\sigma} \frac{1}{\Pr(a3) (1 + \delta_p)}$$

$$\lambda_0 = \delta_{a1} \left[(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(BJ) - (\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) \Pr(\sim BJ) \frac{\Pr(p3)}{\Pr(p2) + \Pr(p3)} \right]$$

$$\lambda_1 = \delta_{a1} \frac{1}{[1 + \Pr(a1)][\Pr(p2) + \Pr(p3)]} \\ \times \min\{(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(p1) [\Pr(p2) + \Pr(p3)] \Pr(BJ), (\rho_{A-J} - \rho_{A-F} \\ + \Gamma_{A-E}) \Pr(p1) [1 + \Pr(a1)] \Pr(p3) \Pr(\sim BJ)\}$$

$$\lambda_2 = \delta_{a1} \frac{1}{[1 + \Pr(a1)][\Pr(p2) + \Pr(p3)]} \\ \times \max\{(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(p1) [\Pr(p2) + \Pr(p3)] \Pr(BJ), (\rho_{A-BP} - \Gamma_{A-E} \\ - \rho_{A-J}) [1 + \Pr(a1)] [\Pr(p2) + \Pr(p3)] \Pr(BJ) \\ - (\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) [1 + \Pr(a1)] \Pr(p3) \Pr(\sim BJ)\}$$

$$\omega = \delta_{a1} \left[(\rho_{A-BP} - \Gamma_{A-E} - \rho_{A-J}) \Pr(BJ) - (\rho_{A-J} - \rho_{A-F} + \Gamma_{A-E}) \frac{[1 + \Pr(p1)] \Pr(p3) \Pr(\sim BJ)}{\Pr(p2) + \Pr(p3)} \right]$$

$$\tau_{p2} = \beta_{P-S} \frac{\Pr(a1) [1 + \Pr(\sim BJ) \delta_p] + \Pr(a2) (1 + \delta_p)}{\Pr(a1) [1 + \Pr(\sim BJ) \delta_p]} - \Gamma_{P-E} \frac{\Pr(BJ) \delta_p}{[1 + \Pr(\sim BJ) \delta_p]} \\ + \Gamma_{P-\sigma} \frac{\Pr(a1) [1 + \Pr(\sim BJ) \delta_p] + \Pr(a2) (1 + \delta_p)}{\Pr(a1) \Pr(a3) (1 + \delta_p) [1 + \Pr(\sim BJ) \delta_p]}$$

$$\tau_{p3} = \beta_{P-S} \frac{\Pr(a1) + \Pr(a2) (1 + \delta_p)}{\Pr(a1)} - \Gamma_{P-E} \delta_p + \Gamma_{P-\sigma} \frac{\Pr(a1) + \Pr(a2) (1 + \delta_p)}{\Pr(a1) \Pr(a3) (1 + \delta_p)}$$