How Do Public Agencies Respond to Budgetary Control? A Theory of Strategic Task Portfolios in Public Administration*

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Abstract

How do public agencies manage diverse programs under limited budgets? Resource constraints force agencies to prioritize tasks, requiring strategic decisions about how to allocate resources effectively. In this paper, I develop a game-theoretical model that explores how agencies shape and restructure their task portfolios under budgetary constraints. In response to budget reductions, I argue that agencies reallocate resources by prioritizing more efficient tasks for improved performance, within their portfolios. To test my theoretical claims, I analyze an original dataset of antitrust cases filed by the U.S. Antitrust Division from 1970 to 2019. As expected, I find that the AD strategically adjusts its litigation portfolio in response to budgetary changes. Specifically, budget cuts prompt the AD to significantly increase its focus on antitrust criminal cases – the most efficient type for improving performance metrics – while reducing attention to other types of cases. This study offers new insight into how public agencies navigate budgetary constraints to achieve their public missions while meeting performance expectations.

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How do public agencies manage diverse programs with limited budgets? As the role of modern bureaucracy has expanded, so has the range of tasks undertaken by individual agencies. Under resource constraints, however, agencies cannot handle all the tasks but must pick and choose among them. This bureaucratic dilemma becomes particularly pronounced when agency goals are ambiguously defined (Chun and Rainey, 2005; Huizinga and de Bree, 2021), tasks are complex and costly (Anderson and Stritch, 2016; Chen, Yang and Yu, 2024; Rasul, Rogger and Williams, 2021), or elected officials manipulate budgets to influence policy outcomes (Weingast and Moran, 1983; Gilmour and Lewis, 2006). Under such conditions, the literature suggests that public agencies are likely to prioritize tasks that are highly visible to their principals or can be completed quickly, often at the expense of their original goals and missions (Holmstrom and Milgrom, 1991; Dewatripont and Jewitt, 1999; Bohte and Meier, 2000; De Mesquita and Stephenson, 2007).

However, this shift does not necessarily indicate a bureaucratic behavior of unaccountability or incompetence. Instead, public agencies could pause to implement their preferred policies and wait for more favorable conditions to come along (see Potter, 2017). In this paper, I argue that public agencies strategically change their priorities given variable budgetary constraints. Under limited resources, agencies can prioritize boosting their performance; with affluent resources, they can shift the focus back to their original goals and missions. This argument centers on the bureaucratic discretion in selecting which task(s) to implement among many (Schinkel, Tóth and Tuinstra, 2020; Patty, 2024). Specifically, I argue that public agencies strategically shape and restructure their task portfolios to align with their current priorities.

Bureaucrats are undeniably strategic actors who actively pursue their policy preferences. Among many strategies, scholars have recently highlighted their longer tenures compared to elected counterparts.[1] Due to their extended time horizons, bureaucrats

[1]For other options, see Niskanen (1971) on exploiting asymmetric information, Brehm and Gates (1999) on shirking and sabotage, and Carpenter (2000, 2010) on reputation building.

can delay the rule-making process and adopt their desired rules when favorable political climates arise (Potter, 2017). However, as Carpenter (2002) notes, waiting is not always an ideal strategy. Especially, in the context of rule enforcement, delaying can be far more conspicuous. For instance, holding up the implementation of existing rules can draw attention from organized stakeholders, the media, and policy recipients, provoke intervention from elected officials, and drive policy outcomes away from their preferred ones (Carpenter, 2002; McCubbins and Schwartz, 1984).

In this paper, I develop a game theoretical model to explore bureaucratic responses to budgetary control in the context of federal regulation enforcement. In this model, an elected official decides the size of an agency's budget, whereas the regulatory agency allocates the budget across multiple regulations. The agency can enforce regulations within a discrete time frame and performance on each task is determined by the resources allocated and the task's efficiency level. Yet, I assume that the efficiency level of a task is not necessarily correlated with its importance to the agency's core mission. By this assumption, I highlight a key bureaucratic dilemma in budget allocation: while the elected official can manipulate the budget to incentivize the agency to perform better, the metrics used to assess the performance may not accurately reflect the agency's contributions to its mission. Under these circumstances, budget cuts may compel the agency to engage only in *efficient tasks* for performance improvement at the expense of *critical tasks* to mission achievement (e.g., Bohte and Meier, 2000; De Mesquita and Stephenson, 2007).

By examining how bureaucrats navigate this dilemma, I broaden our understanding of how public agencies structure their task portfolios under resource constraints. Specifically, I argue that (1) elected officials use budget cuts as an informational cue, signaling the need for the agency to improve its performance (Carpenter, 1996), and (2) in response, the agency reallocates its resources by increasing the share of efficient tasks within its portfolio. This portfolio shift indicates a bureaucratic motivation to enhance resource capacity for future policy implementation. In turn, this model demonstrates that bureaucrats may strategically delay even the rule-enforcing process to achieve their desired policy outcomes. However, unlike rule-making delays, where bureaucrats may "shirk"

their duties until favorable climates arise, they "work" to shape conditions in their favor by restructuring portfolios and demonstrating competency to elected principals (Brehm and Gates, 1999).

As an empirical case, I choose the U.S. Antitrust Division (AD) at the Department of Justice. This regulatory agency is well-suited to my theoretical scope conditions: (1) its mission to protect economic competition is inherently ambiguous and difficult to quantify and (2) it enforces multiple regulations, including criminal, merger, and non-merger civil antitrust cases, with considerable discretion. To test my theoretical claims, I collected an original dataset of antitrust cases filed by the AD from 1970 to 2019. Using dynamic compositional analysis (Philips, Rutherford and Whitten, 2016*a*), I model the agency's enforcement decisions to navigate the trade-offs across different types of antitrust regulations. As expected, I find that the AD strategically adjusts its litigation portfolio in response to budgetary changes. Specifically, budget cuts lead the AD to significantly increase its focus on antitrust criminal cases (e.g., price-fixing and bid-rigging), at the expense of non-merger civil cases in the short term and even merger cases in the long term.

This shift occurs because antitrust criminal cases are the most efficient to win in court, thereby enhancing the AD's performance metrics. Among all antitrust cases, only criminal cases are governed by the *per se* rule – under which, restraints of trade hold to be *per se* illegal without requiring further inquiry into their anti-competitive effects. Thus, the AD (in this case, the plaintiff) only needs to demonstrate that the specific conduct occurred, reducing the effort and resources required and allowing for more confident predictions of case success before litigation, compared to other types of cases (Bork, 1978). These findings provide an alternative perspective on the drivers of increasingly concentrated markets in the United States, emphasizing the strategic role of bureaucrats in antitrust regulation enforcement.

This paper makes three major contributions. First, while major studies on bureaucratic politics have examined mechanisms of political control over bureaucracy (Weingast and Moran, 1983; Banks and Weingast, 1992; Wood and Waterman, 1991, 1993;

Ringquist, 1995), I contribute to the recent literature that examines how bureaucrats respond to political cues to pursue their own policy agendas. Bureaucrats often leverage their longer time horizons to slow-walk implementing policies that conflict with their preferences (Potter, 2017; Rudalevige, 2021). However, such strategic delays are less feasible when confronting immediate pressures, such as budgetary changes. To expand our understanding of bureaucratic responses, in this paper, I investigate how public agencies adapt to budget reductions within a relatively shorter time frame.

Second, I join a growing body of research that models bureaucratic decision-making within a multitask framework.[2] In practice, even a single agency often performs a variety of public tasks simultaneously. Thus, decisions in one policy area inevitably influence the implementation of other policies within the agency. To address this interdependency in policy choices, recent studies model bureaucratic decision-making within the multitask framework. For instance, Patty (2024) explores how agencies proceed with different tasks sequentially, while Schinkel, Tóth and Tuinstra (2020) examine how agency heads incentivize unelected officials to complete various types of tasks. I contribute to this literature by incorporating the endogenous relationship between agency performance and budget into the multitask framework. Rather than assuming budgets as exogenously given and fixed (e.g., Schinkel, Tóth and Tuinstra, 2020), I argue that a more realistic understanding of bureaucracy emerges by examining how bureaucrats' decisions and performance in the previous term influence budget appropriations of elected officials in the current term, and *vice versa*.[3]

[2]The multitask framework refers to principal-agent models in which the agent(s) performs different types of tasks and decides how to implement these tasks under certain constraints (Holmstrom and Milgrom, 1991). For research on the allocation of different tasks and determining who should perform them, see Alesina and Tabellini (2008); Ting (2002, 2003). On the oversight and incentivization of agents managing multiple responsibilities, see De Mesquita and Stephenson (2007); Schinkel, Tóth and Tuinstra (2020). And, on the prioritization and scheduling decisions among multiple jobs, see Patty (2024).

[3]A vast literature, beginning with Wildavski's seminal work (1986), demonstrates that agency budgets are largely endogenously determined – the prior year budgets are always

Third, empirically, I introduce the novel approach of Philips, Rutherford and Whitten (2016*a*) to analyze dynamic trade-offs in regulatory enforcement. Numerous empirical studies have examined budgetary influence on regulatory enforcement. By regressing either a single regulation or overall enforcement levels, these studies consistently find that budgets significantly impact the absolute level of enforcement (Ringquist, 1995; Wood and Waterman, 1991; Wood and Anderson, 1993; Carpenter, 1996). However, because individual agencies oversee various types of regulations, it is critical to understand how budget changes affect the overall composition of the regulatory "pie." Increasing the absolute level of enforcement by prioritizing one regulatory element has substantially different implications for policy outcomes compared to maintaining the relative composition of the pie while changing its total size. I address this empirical gap by employing the dynamic compositional modeling framework (Philips, Rutherford and Whitten, 2016*a*). Unlike traditional methods, this framework examines the proportions of different elements while accounting for correlations among stochastic terms across equations. This approach enables me to provide new insights into how regulatory agencies shape and restructure their enforcement compositions under variable budgetary constraints.

The rest of this article is structured as follows. In the next section, I develop a theory of strategic task portfolios that explains how agencies respond to budget manipulations. I continue to justify my choice of the AD as an empirical case and present testable hypotheses of my theory. Then, I discuss my empirical model of the AD's litigation portfolios and present my findings. I conclude by emphasizing my contributions to the literature and offering some ideas about future research.

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strong predictors of current year appropriations. Moreover, budget is not only proactively but also retrospectively associated with agency performance (Ting, 2001): whereas the size of budgetary constrains the maximum performance of the agency in the current term, changes in the budget size reflect a reward or punishment of its previous performance.

A Theory of Strategic Task Portfolios

Game Ingredients

The players of my game are an elected politician (P) and a government agency (A). For clarity, I refer to the politician and the agency with feminine and neuter pronouns, respectively. The politician appropriates the agency's discretionary budget. Her choice is denoted by $w \in (0, 1]$.

The agency has two tasks, $i \in \{E, D\}$, which have different *efficiency* levels of $\rho_i \in (0, 1]$ and $\rho_E > \rho_D$. Substantively, I interpret that tasks with higher ρ are more efficient in transforming resources into measurable performances.[4] The agency decides how to allocate its budget across tasks. The proportion of the budgets allocated to task i is denoted by $r_i \in [0, 1]$, and thus, $\sum r_i = 1$. For brevity, I denote the budget proportions of tasks E and D as r and $1 - r$, respectively. The performance of task i is jointly determined by the efficiency level and the allocated budgets, and the overall agency's performance is a sum of the performances of every task:

$$\begin{aligned} y &= y_E + y_D \\ &= \rho_E r w + \rho_D (1 - r) w, \end{aligned}$$

where y denotes the overall performance and y_i denotes the task i performance. The overall performance is increasing in r, since $\frac{\partial y}{\partial r} = (\rho_E - \rho_D)w > 0$. This is consistent with my assumption that the agency can enhance its overall performance by putting more resources into more efficient task types (Figure 1b).

[4]For example, the U.S. Environmental Protection Agency (EPA) pays higher costs to enforce environmental regulations against public organizations, which may overturn the enforcement using their stronger political connections (Konisky and Teodoro, 2016), and the U.S. Food and Drug Administration (FDA) bears higher risks of approving lethal drugs in markets, which may have significant side-effects on patients (Carpenter, 2002).

For the actors' payoffs, I have the politician's utility function as:

$$U_P = -\mathbb{1}(y < \tau),$$

where $\mathbb{1}$ is the indicator function and τ refers to the performance threshold, which gives the politician utility by -1 if the agency performs lower than the threshold and 0 otherwise. The nature draws the performance threshold from the uniform distribution of $U(\rho_D, \rho_E)$.[5] However, I assume that the threshold level is not public information both to the politician and the agency, and so, for both time 1 politician ($P_{t=1}$) and agency ($A_{t=1}$), the prior beliefs of the threshold are $\tau \sim U(\rho_D, \rho_E)$.

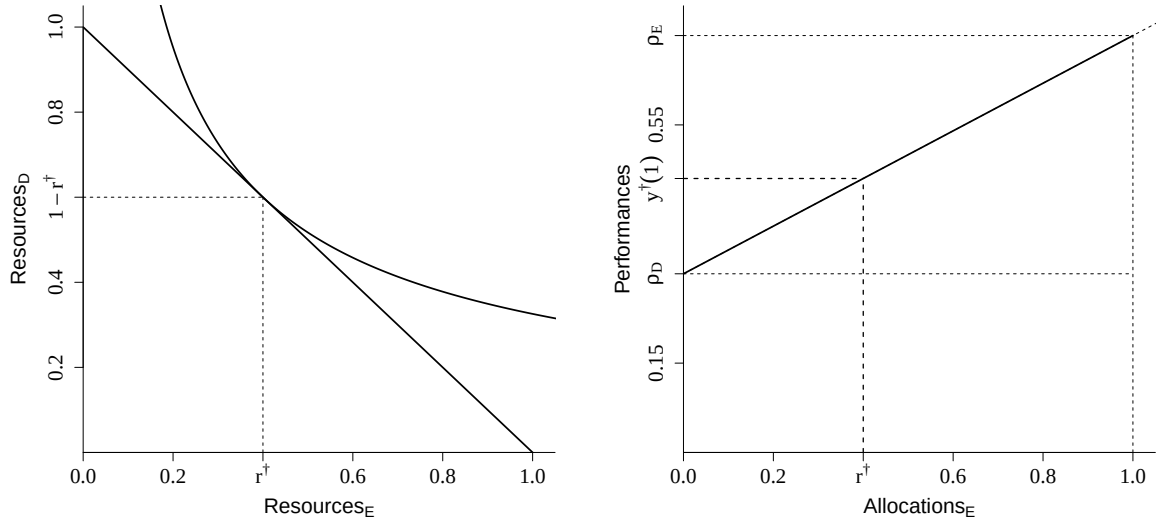
I specify the agency's utility function as:

$$U_A = \alpha \ln y_E + (1 - \alpha) \ln y_D,$$

where $\alpha_i \in [0, 1]$ refers to the agency's intrinsic weight on task i and $\sum \alpha_i = 1$. For simplicity, I denote the weights on tasks E and D by α and $1 - \alpha$, respectively. We can interpret this term as the value the agency assigns to each task, which is exogenously given by socialization, professional norms, or the influence from a new group of experts (Wilson, 1989; Meier and O'Toole, 2006; Eisner and Meier, 1990).

To sum up, the politician incurs negative utility only when the agency fails to meet the performance threshold. However, the politician cannot proactively compel the agency to exceed this undisclosed threshold. Instead, the politician's negative utility serves as a signal that the agency's past performance fell below the threshold. This retrospective evaluation aligns with the "fire alarm" mechanism described by McCubbins and Schwartz (1984). For instance, in specialized and complex regulatory areas such as antitrust policy, politicians may lack prior knowledge and expectations about how agencies should enforce specific regulations and to what degree. However, citizens - in this model, non-strategic actors who sound the alarm outside of the game - can observe and react to agency under-

[5] ρ_D and ρ_E are the upper and lower bound of the agency performance given the maximum budget of 1, respectively.



(a) Budget Line and Indifference Curve (b) Performance and Budget Allocations

Figure 1: Agency's Optimal Budget Allocation and Overall Performance at the Baseline. Parameter Values: $w = 1$, $\rho_E = 0.7$, $\rho_D = 0.3$ and $\alpha = 0.4$.

performance. When markets become overly concentrated, citizens recognize it and alert politicians, signaling that the regulatory agency has failed to meet their expectations.

In Figure 1, I demonstrate the agency's budget allocation and overall performance at a baseline, where the politician appropriates the budget of $w = 1$ at a single period game. Figure 1a represents the agency's budget line and indifference curve in straight and curved lines, respectively. The budget line indicates a possible set of budget allocations among tasks D (y-axis) and E (x-axis) under the budget constraint, whereas the indifference curve represents a set of budget allocations that provides an identical utility to the agency. An upper-right shift in the indifference curve indicates an increase in the agency's utility. As such, the budget allocation, of which the indifference curve is tangential to the budget line, maximizes the agency's utility under the budget constraint. I refer to the budget proportion allocated to task E, which maximizes the agency's utility, as $r^\dagger$. This budget proportion is equal to α and independent of the budget size. **Proofs** are in the Appendix.

Lemma 1. *The budget proportion allocated to task E that maximizes the agency's utility under any budget constraint of w is* $r^\dagger(w) = \alpha$.

Figure 1b indicates the overall performance as the function of resources allocated into task E. Under the budget constraint of $w = 1$, the agency would achieve the minimum

and maximum of the overall performance as ρ_D and ρ_E, respectively. As discussed above, the overall performance is increasing in resources allocated to task E. When allocating $r^\dagger w$ to task E, the agency will produce $y^\dagger(w) \equiv \rho_D w + \alpha w(\rho_E - \rho_D)$. To summarize, the sequence of moves is:

1. Nature draws $\tau \sim U(\rho_D, \rho_E)$, and privately informs only to the nature itself.
2. At $t = 1$, the politician decides the size of the budget $w_1 \in (0, 1]$.
3. Given the budgets w_1, the agency decides the allocation $r_1 \in [0, 1]$.
4. Observing the agency's last performance y_{t-1}, the politician appropriates new budgets w_t at period t.
5. Under the new constraint of w_t, the agency decides the budget allocation r_t.
6. Rounds 4 and 5 are repeated until time 3.

In this theoretical model, I explore strategic interactions between politicians and agencies through endogenous budget appropriations. Elected politicians (and citizens) anticipate agencies to reach a certain standard of performance. However, the ambiguity and complexity of specialized policy areas often pose a challenge, as these performance metrics may not accurately reflect the agency's contributions to public missions. Consequently, government agencies might find themselves caught in a dilemma between improving performance metrics and achieving their primary goals and missions. This game is designed to illustrate how regulatory agencies respond to budgetary pressures and navigate through this dilemma.

Insights from the Complete Information Game

Before exploring the incomplete information setting, I first examine the Subgame Perfect Nash Equilibrium (SPNE) under the assumption of complete information. In this setting, the level of the performance threshold (τ) is publicly known to both the politician and the agency. I restrict my attention to the case where $\tau > y^\dagger(1)$. If this condition is not met, the politician would be able to ensure agency performance over the threshold across all rounds while the agency simultaneously maximizes its utility by the budget allocation

of $r^* = \alpha$. This scenario does not offer a conflict of interests that necessitates strategic decision-making, and hence, I focus on the more interesting case where $\tau > y^\dagger(1)$. For the sake of simplicity, let's assume the game only unfolds over two rounds.

Proposition 1. *Under the complete information and $\tau > y^\dagger(1)$, the agency chooses the first-period budget allocation (r_1^*) such that the agency performance equals the performance threshold given the first-period budget, $y_1(r_1^*, w_1^*) = \tau$. In the second period, the agency selects the budget allocation (r_2^*) that maximizes its utility in the second period, i.e., $r_2^* = \alpha$.*

Proofs are in the Appendix. Using backward induction, the agency chooses the budget allocation as $r^\dagger$ in the final period, regardless of the budget size (Lemma 1). This leads to a certain failure to meet the performance threshold, so the politician becomes indifferent to offering any size of budget in the final round.

However, P's indifferent set of second-period budgets presents an opportunity for the politician to leverage a credible threat to improve the first-period performance. Since she is indifferent to any level of the second-period budget, the politician can credibly propose a substantial second-period budget cut for the final round only when the agency fails to meet the performance threshold in the first period. The threat of a budget reduction pressures the agency to perform at a level of the performance threshold. Consequently, the agency meets the performance threshold in the first period, obviating the need for the politician to cut the budget in the second period. In this scenario, the prospect of a substantial budget reduction serves as an effective tool for the politician to influence the agency's budget allocation decisions.

Theoretical Insights from the Incomplete Information Game

Now, let's turn our attention to the incomplete information game. I use a solution concept of Perfect Bayesian Equilibrium (PBE) to find an equilibrium in the incomplete information setting. In this setting, neither the politician (P) nor the agency (A) knows the exact level of performance threshold, τ. The symmetric uncertainty of the performance

threshold across the politician and the agency underscores the challenges of prospectively identifying how regulations should be enforced in complex policy areas. Yet, the learning process varies between these two actors.

On the one hand, the politician acquires new information about the performance threshold by observing her utility. According to the model setup, she will experience a negative utility only if the agency fails to meet the performance threshold. Therefore, when having a negative utility from the previous term, she can deduce that the agency's performance was below the threshold, leading her to update the posterior beliefs of the threshold's lower bound. Conversely, if the politician did not experience a utility discount, she can update the upper bound of the performance threshold, learning that the agency's performance in the previous term was above the threshold.

On the other hand, the agency can gain new information only if the politician's budget strategy for the current term is dependent on whether the agency met the performance threshold in the previous term. If this is not the case, the agency cannot discern whether it was successful and, consequently, maintains its previous posterior beliefs even in the current term. However, when the politician holds different strategies, the agency can learn and update its posterior beliefs by observing the current budget provided by the politician. This learning process is consistent with findings of Carpenter (1996): budgeting has a novel function beyond mere political control, disseminating new information to government agencies. If politicians appropriate budgets differently, agencies can learn the necessity of improved performance.

And, I make a small change in the performance function as:

$$y_i = \rho_i(r_i + e)w,$$

where e is a positive number close to zero. This change enables me to define the agency's utility function under the choices of $r = 1$ and 0. One can interpret this term e as representing the bureaucratic effort, which contributes to agency performance apart from the amount of resources allocated to a specific task. Within this setup, although not unique, there exists a Perfect Bayesian Equilibrium where on-the-path:

Proposition 2. *Under the incomplete information about τ, the agency chooses the first-period budget allocation as $r_1^* > r^\dagger$. If the first-period performance does not reach the threshold level ($y_1^* < \tau$), the agency will allocate the entire budget of $w_2^* = 1-\epsilon$ to task E, i.e., $r_2^* = 1$. Conversely, if the agency exceeds the threshold in the first period ($y_1^* \geq \tau$), the agency will choose the second-period budget allocation as $r_2^* = r^\dagger$ given the budget of $w_2^* = 1$. In both scenarios, the final-period budget size (w_3^*) and allocation (r_3^*) are 1 and $r^\dagger$, respectively.*[6]

Proofs are in the Appendix. Similar to the previous case, the agency chooses the budget allocation of $r^\dagger$ in the final round, regardless of the budget size (Lemma 1). And, this choice forms an indifferent set of third-period budgets for the politician, which she can use to make a credible threat under specific conditions:

$$w_3' = \begin{cases} (0,1] & \text{if } y^\dagger(1) < \underline{\tau}_2^P, \\ 1 & \text{if } \underline{\tau}_2^P \leq y^\dagger(1) \leq \overline{\tau}_2^P, \\ [\underline{w}^\dagger(\overline{\tau}_2^P), 1] & \text{if } \overline{\tau}_2^P < y^\dagger(1), \end{cases}$$

where $\underline{w}^\dagger(\cdot)$ indicates the size of the budget which produces a bureaucratic performance under $r = r^\dagger = \alpha(1+2e) - e$. To summarize, the politician is indifferent to any size of the agency's budget when the maximum achievable performance in the final round, denoted as $y^\dagger(1)$, cannot reach her second-period posterior belief of the lower bound, $\underline{\tau}_2^P$. If $y^\dagger(1)$ is located within the posterior beliefs of the potential range of τ, she will offer the maximum budget of 1 to maximize her expected utility. Last, if $y^\dagger(1)$ is over her posterior belief of the upper bound, $\overline{\tau}_2^P$, then she is indifferent to giving the budget from the minimum budget that can achieve the performance of $\overline{\tau}_2^P$ given the budget allocation of $r^\dagger$, symbolized as $\underline{w}^\dagger(\overline{\tau}_2^P)$, to 1. Hence, the extent to which the politician can credibly issue a threat depends on the history leading up to the final round.

For example, the politician can suggest a substantial budget cut for the final round

[6]Note that $r_1^* = \frac{K-1+\sqrt{(K-1)^2+4K(\alpha+2\alpha e+eK+e^2K-e)}}{2K}$, $K = \ln\frac{(1-\alpha)(1+2e)}{e(1-\varepsilon)} + \alpha\ln\frac{\alpha e}{(1-\alpha)(1+e)}$, $\epsilon = \frac{e}{1+e}$, and $r^\dagger = \alpha(1+2e) - e$.

if the agency fails to meet the threshold in the second period. This strategic move incentivizes the agency to avoid a potential final round budget cut by dedicating the entire budget to task E and maximizing its performance in the second period. However, this threat is credible only under the historical condition where the first-period performance, although exceeding $y^{\dagger}(1)$, still fails to meet the threshold - thereby leading the politician to expect certain failure in the final period regardless of the budget choice.

On the other hand, if the performance surpassing $y^{\dagger}(1)$ met the threshold initially, the politician cannot update the lower bound of her posterior belief about τ, leading to a severe limitation in P's indifferent sets of the third-period budget. In this scenario, therefore, she becomes incapable of influencing the agency's budget allocation in the second period.

In the first period, the agency selects a budget allocation of $r_1^* > r^{\dagger}$ due to the risk of failing to meet the performance threshold. By channeling more resources towards task E and elevating the performance beyond $y^{\dagger}(w_1^*)$, the agency aims to heighten the likelihood of first-period success. Such success in the initial period would enable the agency to pursue the budget allocation of $r^{\dagger}$ in both subsequent periods, thereby maximizing its expected utility under the given constraints. This strategic approach, therefore, highlights the agency's precautionary behavior to safeguard against the potential for substantial budget cuts in the following rounds.

However, these strategic calculations are only feasible if the agency can ascertain whether it has succeeded or failed to meet the performance threshold in the first period. To allow the agency to learn the current state of the world, the politician must adopt different budget choices depending on the agency's success or failure in the first period. Given that the agency will opt for the second-period budget allocation as $r^{\dagger}$ if it succeeded in the first period, the politician cannot propose a budget cut that would enhance the likelihood of the second-period failure in this scenario. Conversely, if the agency failed in the first period, the politician could only reduce the budget to a level that realizes $\overline{\tau}_1^P = \rho_E$ with the budget allocation of $r_2^* = 1$. This stipulation leads to $w_2^*|_{y_1^* < \tau} = 1 - \epsilon$ where $\epsilon = \frac{e}{1+e}$, implying a marginally reduced budget for the second period upon first-period

failure. Therefore,

Hypothesis 1. *In response to a budget reduction, the agency will increase the proportion of the budget allocated to efficient tasks compared to the previous term.*

In comparison to the complete information setting, three major implications emerge: first, due to the undisclosed threshold, the agency is faced with the risk of failing to meet the threshold in the first period, even though it may over-allocate its resources to more efficient tasks than it would ideally prefer. Second, the incomplete information setting paradoxically widens the agency's room to pursue its professional beliefs and preferences. This is because the uncertainty surrounding the threshold level severely limits the politician's ability to make a credible threat of significant budget cuts. Third, unlike the complete information game, a budget cut may occur if the agency fails to meet the threshold in the first period. However, in this case, the budget cut functions more as a means of transmitting information and updating the agency's beliefs about the current state of the world, rather than serving as a punishment for the previous failure.

An Empirical Case: the U.S. Antitrust Division

I choose the AD as my primary case for empirical evaluation. The AD is well-suited to test my theoretical claims about bureaucratic responses to budgetary changes. First, the agency's contribution to its ambiguous missions – such as promoting competition and protecting economic freedom – is difficult to measure precisely. This difficulty is further exacerbated by unclear statutory languages. For example,

> *What constitutes "unfair methods of competition in commerce and unfair or deceptive acts or practices in commerce" is not self-evident. To state, as does section 7 of the Clayton Act, that a practice is unlawful when its "effect may be to substantially lessen competition or tend to create a monopoly" says little; the meaning of the phrases "may be," "substantially lessen," and "tend to create" demand definition. (Katzman, 1981, page 3)*

Depending on how these terms are interpreted, antitrust enforcement can serve diverse but often conflicting purposes, such as limiting the influence of large corporations, maintaining market diversity, preserving small businesses and local ownership, or promoting consumer welfare. Expert interpretation is therefore essential to navigate and reconcile the tensions between competing goals in antitrust enforcement.

However, different groups of experts, shaped by different trainings, professional norms, and career trajectories, diverge in their interpretation and prioritization of antitrust goals (Katzman, 1981; Eisner and Meier, 1990; Eisner, 1991). For instance, Katzman (1981) highlights the tension between attorneys and economists in antitrust case-load decisions. Attorneys, trained with a prosecution-oriented mindset, prioritize securing trial experience to advance their career prospects. In contrast, economists, who are generally more cautious about government intervention, emphasize aligning enforcement actions with consumer welfare and avoiding unnecessary disruptions to market places (Katzman, 1981, chapter 4).

Furthermore, the interpretation of antitrust goals can evolve over time, even within the economics profession (Eisner and Meier, 1990; Eisner, 1991). Until the early 1970s, the Structure Conduct Performance (SCP) paradigm in industrial organization economics dominated the antitrust policy community. Structuralists argued that market concentration facilitated anti-competitive behavior, linking oligopolistic markets to negative economic outcomes such as inflation, unemployment, and reduced innovation (Weiss, 1978). This perspective led to a focus on structural remedies, particularly targeting monopolies and mergers in antitrust enforcement.

The rise of the Chicago School in the 1970s challenged the SCP framework, asserting that market concentration reflected efficiency rather than collusion. Chicago School economists viewed large, profitable firms as products of efficiency and criticized structural interventions as unnecessary or even harmful (Demsetz, 1974; Bork, 1978). As Chicago School economists increasingly moved into antitrust agencies during the Reagan administration, antitrust priorities were redefined as from structural remedies to price-fixing cases. This shift in antitrust priorities due to the new economics paradigm has even in-

fluenced elected politicians, who, in turn, adjusted the assessment measures for evaluating antitrust agency performance (Eisner, 1991).

Second, the AD determines enforcement priorities in a highly centralized decision-making structure, with considerable discretion of budget allocations. Unlike some federal agencies, the AD operates with a fully discretionary budget, free from earmarks. Earmarks, also known as "congressionally directed spending," enable legislators to portion out agency funds to specific projects or jurisdictions, thereby constraining agency discretion in budget allocation.[7] The absence of earmarks gives the AD greater flexibility in determining how to allocate its resources across different enforcement priorities.

As the head of the antitrust agency, the Assistant Attorney General (AAG) has the final authority over antitrust case-load decisions. While staff attorneys and economists conduct the day-to-day investigations and litigation, their work is closely supervised by high-ranking officials. The decision to open a preliminary investigation must first be approved by the Office of Operations, and for high-profile cases, the AAG may also be involved. However, any decision to proceed with or close a lawsuit requires direct approval from the agency head. Based on the AAG's litigation choices, the agency's budget is allocated across different cases. Due to this centralized decision-making structure, enforcement decisions in one antitrust case inevitably influence subsequent decisions in others (Wood and Anderson, 1993).

Most importantly, the regulatory agency faces significant budgetary constraints in bringing big, resourceful enterprises to courts. The AD cannot pursue every violation of antitrust laws; must strategically calculate case-load decisions. Beyond having sufficient reasons to believe that a practice has anti-competitive effects, regulators need to determine that pursuing this particular case serves the public interest, relative to other actions that could have been taken instead. These strategic considerations often result in

[7]For example, the Environmental Protection Agency (EPA) administered 491 earmarks totaling $859.3 million (9.0% of its total budget) in fiscal year 2022, a figure that increased to $1.5 billion (14.8% of its total budget) in fiscal year 2023. Most of these earmarks were designated for water quality protection and various community projects.

divergent enforcement approaches: at time, regulators focus on responding to complaints and pursue cases of evident violation, while at other times, they allocate resources to preemptively target structural issues with broader economic implications (Katzman, 1981).

A prominent example is antitrust lawsuits against Facebook (now Meta). Despite concerns about market competition in the platform economy dating back to the early 2010s (Waller, 2012; Yoo, 2012; Srinivasan, 2019), it was not until December 2020 that the AD and the FTC filed antitrust lawsuits against Facebook.[8] As Facebook rapidly grew into one of the wealthiest companies in the world, these underfunded antitrust agencies confronted financial challenges in bringing this tech giant to courts. To address these financial constraints, the AD requested for an exceptional 70% increase in congressional appropriations, while the FTC considered filing fewer cases and tightening litigation expenses to manage their limited resources effectively.[9] This example illustrates that, to pursue *critical* cases to antitrust missions, these regulatory agencies must strategically restructure task portfolios, especially when operating under constrained budgets.

An Overview of the Antitrust Enforcement Process

The AD promotes fair and free competition in the marketplace by enforcing U.S. antitrust laws, including the Sherman Act of 1890, the Clayton Act of 1914, and various amendments. Federal antitrust laws mainly prohibit three primary anticompetitive behaviors: (1) restraint of trade, such as fixing prices or rigging bids (Section 1 of the Sherman Act), (2) likelihood of mergers and acquisitions to reduce competition in a market (Section 7 of the Clayton Act), and (3) predatory acts designed to achieve or maintain monopoly power (Section 2 of the Sherman Act). The AD is authorized to bring both criminal and civil actions in antitrust matters. Yet, the AD and the FTC share jurisdiction over civil

[8]Also for the concerns from the industry, *see* `http://martysmind.com/2010/05/19/should-ftc-file-facebook-antitrust/`.

[9]For the AD, *see* `https://www.politico.com/news/2020/02/10/doj-bump-antitrust-enforcement-113340`, and for the FTC, *see* `https://www.politico.com/news/2020/12/10/ftc-cash-facebook-lawsuit-444468`.

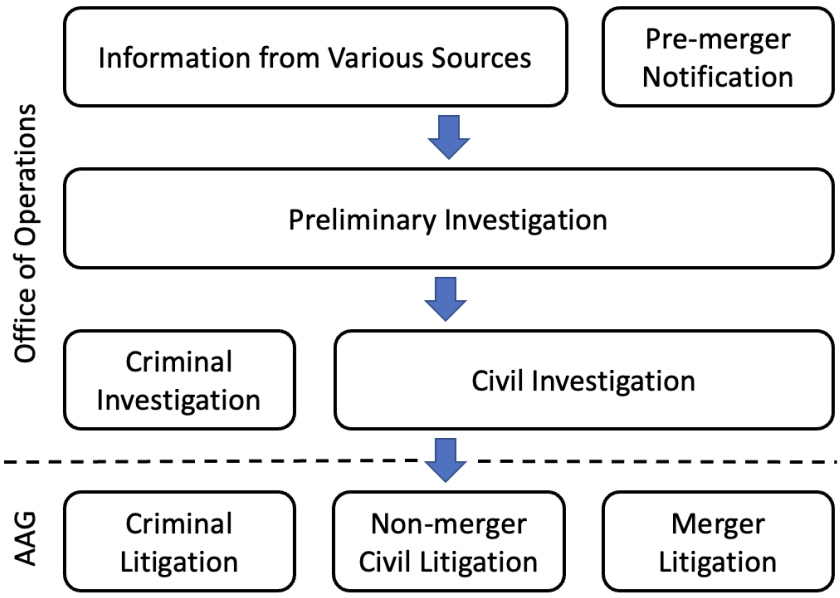


Figure 2: Enforcement Process and Types of Antitrust Litigation.

antitrust enforcement, so the AD should clarify its case initiative with the FTC before conducting a civil investigation.

Based on the enforcement process (Figure 2), antitrust litigation can be categorized into criminal, merger, and non-merger civil cases. First, most criminal cases involve breaches of Section 1 of the Sherman Act (restraint of trade). Section 7 of the Clayton Act (merger) regulates only civil procedure, and the AD has not criminally prosecuted Section 2 of the Sherman Act (monopoly) since 1978. Thus, the AD files criminal litigation mainly to terminate the restraint of trade. Second, merger cases compose an independent component of civil litigation. A unique channel of information triggers merger investigations. By the Hart-Scott-Rodino Antitrust Improvements Act (1976), enterprises with mergers or acquisitions in excess of certain thresholds should notify antitrust agencies of their plans in advance. As such, the AD can review the proposed transaction prior to consummation.[10] In this type of case, the AD seeks to prohibit the likelihood of transactions from reducing market competition in the future. Last, civil non-merger cases address antitrust matters under Sections 1 (restraint of trade) or 2 of the Sherman Act (monopoly) or Section 3 of the Clayton Act (tying).

[10] *See Antitrust Law Development* (2017), pages 356-8 and 685.

The AD enforces federal antitrust laws through investigation and litigation(Wood and Anderson, 1993). The AD initiates preliminary investigations when being informed of potential violations through various sources, including consumers or injured parties, the press or suspicious pricing patterns, other government agencies, and pre-merger notifications. In preliminary investigations, division staffs analyze affected markets by reviewing public documents and requesting additional information. Depending on the type of anti-competitive practices involved, the AD can conduct more intensive criminal or civil investigations. For civil investigations, division economists play a crucial role in evaluating the anti-competitive effects of the practice on the market. In contrast, market analyses are not involved in antitrust criminal cases, where *per se* rule governs. During this phase, regulated entities can negotiate and cease potentially anti-competitive behaviors before being prosecuted. Litigation occurs if the AD cannot find a satisfactory resolution. The AD pursues criminal actions to terminate and punish past violations, i.e., restraint of trade. In civil litigation, the AD seeks court orders forbidding future violations (merger cases) and requiring steps to remedy the anti-competitive effects of past violations (non-merger civil cases).

The Office of Operations can choose whether to proceed with preliminary and intensive investigations, whereas the agency head, the Assistant Attorney General (AAG), decides whether to initiate litigation or close the case. The regulatory agency operates the discretionary budget, meeting approximately a zero balance in the budget by the end of the fiscal year.

Antitrust Performance Metrics and Case Efficiency

The AD annually reports its enforcement performance and goals to Congress for the next fiscal year's budget. A demonstration of good performance is a measure of the agency's competency, thereby justifying a demand for higher budgets. Two main criteria broadly define antitrust enforcement performance: (1) success rates refer to how many cases in the year have resulted favorably to the AD, and (2) consumer savings indicate the estimated effects of successful enforcement on consumers and relevant markets. Among

various types of antitrust litigation, criminal litigation is the most efficient in enhancing the ratings of the performance measures, especially for success rates.

First, criminal litigation is expected to have the highest likelihood of success among all antitrust cases. This is because courts apply different modes of scrutiny to antitrust cases depending on case type, and the plaintiff (AD) bears more burden of proof in civil litigation (Carrier, 2019; Hovenkamp, 2018). On the one hand, the rule-of-reason governs civil litigation, including merger and non-merger civil cases. Under the rule-of-reason, courts first require the plaintiff (AD) to show how the practice undermines or will undermine economic competition in the relevant market. Proving anti-competitive effects is a difficult process in which economic analyses are involved to define the relevant market and estimate the economic effects of the practice in that market. In particular, there is a heavier burden on merger cases, as the AD should predict the anti-competitive effects of the future transaction. For instance, the AD's failure to show anti-competitive effects led to the dismissal of 97% of cases from 1999 to 2009 (Carrier, 2019). Even if the plaintiff established this element, the defendant can provide evidence that the AD does not accurately predict anti-competitive harm or that the practice has (will have) legitimate pro-competitive effects. One attorney noted,

> *"Structural cases [often] involve complicated economic arguments, which have not been swallowed whole by the courts. Consequently, with a structural case ⋯ you're always on pins and needles, worrying that the court may not buy your argument." (Katzman, 1981, page 28)*

On the other hand, antitrust criminal cases are examined under *per se* rule. Violations of Section 1 Sherman Act (such as price fixing and bid rigging) are considered *per se* anti-competitive and illegal without any examination of actual economic effects (Bork, 1978; Carrier, 2019; Connolly, 2020). For instance, if the plaintiff demonstrates rigid evidence, such as tape recording, notes of meetings, or testimonies, that the defendant engaged in an illegal conspiracy to restrain interstate or foreign trade, the court will consider the practice as *per se* anti-competitive trade without further inquiry. In such a case,

the defendant will not be entitled to justify the behavior by claiming its pro-competitive effects.[11]

One might question whether the burden of proof is heavier in criminal cases, where the legal standard is "beyond a reasonable doubt," compared to the "preponderance of the evidence" standard in civil cases. However, under the *per se* rule, the jury does not evaluate whether the alleged agreement was reasonable, as agreements that restrain trade are conclusively presumed illegal in antitrust criminal cases.[12] Once the court determines that the *per se* rule applies, the jury is instructed that the plaintiff has proved the agreement as a restraint of trade "beyond a reasonable doubt." The jury's sole responsibility is to determine whether the defendant knowingly participated in the charged agreement (Connolly, 2020). This application of the *per se* rule has been reaffirmed in 2020, when the Supreme Court denied certiorari in a petition challenging the constitutionality of the *per se* rule in antitrust criminal cases.[13]

Division's annual Congressional budget submissions provide supportive evidence. These reports contain the agency's performance goals for the upcoming fiscal year, including success rates.[14] Typically, the agency sets a higher success rate for criminal litigation than

[11] *See Antitrust Law Development* (2017, Ch. 10).

[12] *See* Arizona v. Maricopa County Medical Society, 457 U.S. 332 (1982), which states that under the *per se* rule there is "a conclusive presumption that the restraint is unreasonable." Additionally, Alleyne v. United States, 570 U.S. 99, 104 (2013); United States v. Gaudin, 515 U.S. 506, 510 (1995).

[13] Sanchez v. United States, No. 19-288. (2020). Certiorari denied.

[14] The success rate for criminal matters is calculated as: the denominator comprises the total number of criminal cases initiated in the specified fiscal year and prior years that reached a final resolution – such as a guilty plea, trial conviction, trial acquittal, directed verdict, charge dismissal, or other resolution – within the specified fiscal year. The numerator includes successful cases that resulted in guilty pleas or trial convictions, excluding those ending in acquittals, directed verdicts, or charge dismissals.

For civil matters, successful cases include positive outcomes even without trial conclusion – such as mergers abandoned due to Division actions before and after initiating

	Expectation
Merger to Criminal	$\downarrow$
Non-Merger to Criminal	$\downarrow$
Non-Merger to Merger	$-$

Table 1: Expected Effects of Budget Reduction on Litigation Ratios.

those for merger and non-merger civil cases. For the 2022 fiscal year, the performance goal of criminal cases was a 90% of success rate, whereas the goals for the other case types were an 80% of success rate (refer to the Appendix). This difference arises because the AD can make more accurate predictions on the conviction of antitrust criminal cases, which are governed by the *per se* rule, based on collected evidence.

Second, criminal lawsuits can have more immediate and visible effects on the market than civil litigation, especially merger litigation. Winning criminal lawsuits results in terminating the past restraint of trade, such as price fixing or bid rigging, which leads to dropping the product price or increasing the product's supply. In contrast, merger lawsuits aim to prevent future transactions from impeding market competition. Successful merger litigation does not lead to any change in the market but retains the status quo. Furthermore, criminal litigation usually takes shorter than civil litigation. For example, monopolization enforcement (non-merger civil litigation) sometimes costs the agency a tremendous amount of time and effort. The lawsuit against Microsoft ended eight years after the AD took the case from the FTC in 1993, and litigation against American Express began in 2010 and concluded in 2018. In a nutshell, antitrust criminal litigation can affect consumers and markets more vividly for a shorter period than civil litigation.

Strategic Antitrust Litigation Portfolios

My theoretical model predicts that regulatory agencies respond to budget cuts by reallocating resources toward more efficient tasks, often at the expense of less efficient ones.

compulsory processes, mergers resolved through "fix first" remedies, mergers resolved via consent decrees, and mergers resolved prior to trial conclusion – and cases litigated successfully to judgment with no pending appeals.

Table 1 presents the empirical implications of my theoretical model, demonstrating how the Antitrust Division (AD) restructures its litigation portfolio in response to budget reductions. As previously discussed, among various types of antitrust litigation, criminal litigation is the most efficient at improving the Division's performance metrics, particularly the success rate. Therefore, I hypothesize that when the AD faces budget cuts, it will increase the proportion of criminal cases in its litigation portfolio relative to other types of antitrust cases. However, I do not provide a specific hypothesis regarding the relative allocation between non-merger and merger cases, as the theoretical implications for this relationship remain unclear.

In Figure 3, I display the AD's litigation portfolio from 1970 to 2019, with criminal cases represented in dark gray, non-merger civil cases in light gray, and merger cases in gray. All configurations sum up to 1. Years with budget cuts are indicated using bars with reduced transparency, and budget figures have been adjusted for inflation based on the Consumer Price Index. For instance, if the price-adjusted budget in 1981 was reduced compared to 1980's, the area from 1980 to 1981 is marked with low transparency. During the period of interest, the AD experienced 22 budget cuts. Refer to the Appendix for the time-series graph in absolute terms.

I expect to find that the proportion of criminal litigation increases during years of budget cuts and decreases in years of budget increases. Although this analysis is observational, similar patterns can be observed in certain periods: such as from the early 1980s to the mid-1990s and from the early 2010s to the mid-2010s. During these periods, the proportion of criminal cases appears to increase or at least remain stable in years of budget cuts, while it declines sharply when the agency experiences budget increases.

There are, of course, a number of potential confounding factors. For example, in the early years, the rise of the Chicago School and the influence of the Reagan administration led the regulatory agency to move away from structural remedies and focus on price-fixing cases (Eisner and Meier, 1990; Wood and Anderson, 1993).

Nevertheless, it is noteworthy that a similar pattern emerged during the Democratic Obama administration, where the influence of the Chicago School has waned. In early

2011, President Obama proposed significant budget cuts for antitrust agencies, criticizing the preceding decade's antitrust enforcement as the weakest in half a century.[15] The message accompanying these cuts was clear: antitrust agencies needed to improve their enforcement performance to justify reclaiming their budgets. Responding to this political cue, in October 2010, the AD proposed a plan to consolidate its operations and prioritize larger criminal investigations.[16]

In conclusion, these budget reductions posed a significant challenge for antitrust agencies, making it even more difficult to enforce regulations against powerful, well-resourced corporations like Facebook. One antitrust official stated that"[the anti-trust officials] want to be able to handle all the anti-competitive deals, and not pick and choose among them."[17] Thus, it is essential to examine the effects of budgetary constraints on the AD's case-load decision. In the next section, I employ a dynamic compositional analysis to investigate how budget reductions reshape antitrust litigation portfolios, while accounting for the influences of potential confounding factors.

Methods

Data and Measurements

I test my theoretical claims using the data on the types of cases filed by the AD from 1970 to 2019. The AD provides workload statistics, including the yearly numbers of investigations and lawsuits by case type.[18] To explore the trade-offs between multiple antitrust regulations, I use the proportions of different types of antitrust litigation pursued

[15]Statement of Senator Barack Obama for American Antitrust Institute, *available at* https://www.documentcloud.org/documents/2993125-Aai-Presidential-Campaign-Obama-9-07-092720071759.

[16]*See* https://www.washingtonpost.com/blogs/federal-eye/post/justice-department-lawyers-irked-by-plans-to-close-offices/2011/10/17/gIQAzZ7EsL_blog.html.

[17]*See* https://www.wsj.com/articles/BL-LB-38899.

[18]*See* https://www.justice.gov/atr/division-operations

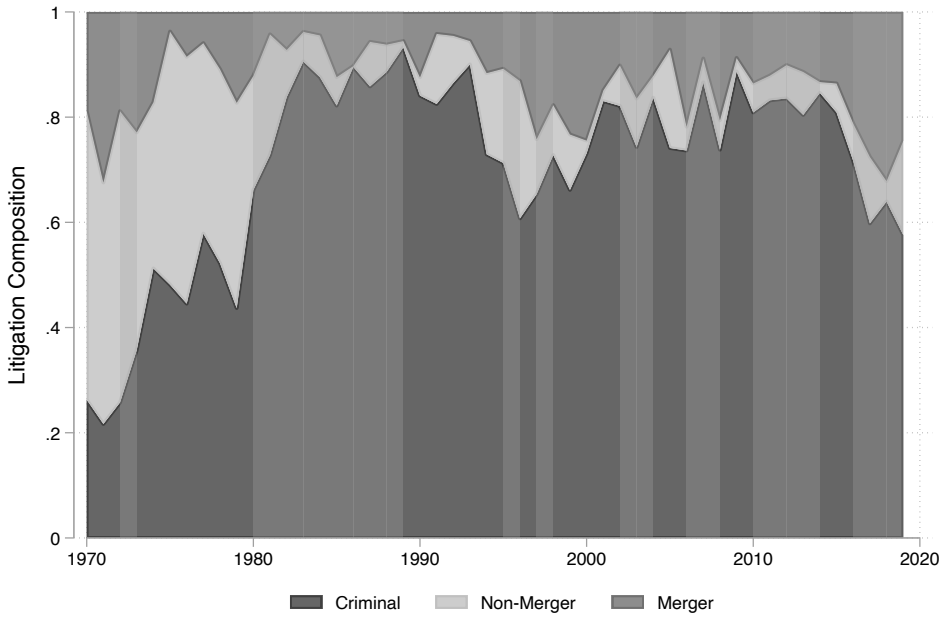


Figure 3: Antitrust Litigation Portfolios from 1970 to 2019.

by the AD in the year. To calculate these proportions, I include only cases filed by the AD in the specific year. I classify AD's litigation into criminal, merger, and non-merger civil cases. Thus, y_{it} refers to the litigation proportion of case type i in year t. By definition, in any year, $0 \leq y_{it} \leq 1$ and $\sum_{i=1}^{N} y_{it} = 1$.

My primary independent variable is budget reduction, a dummy variable indicating whether the amount of the AD's approved budget in year t is lower than that in the preceding fiscal year, $t-1$. Specifically, a value of 1 represents a budget reduction in year t. Note that the budget figures are adjusted for inflation using the consumer price index, so if the AD's budget fails to keep pace with inflation, the value of this variable for that year is coded as 1. During the period of interest, the AD experienced 22 instances of budget reduction.

The validity of this coding scheme may be questioned, as the AD could respond differently depending on the magnitude of the budget reduction. For instance, it is plausible that the AD's response would vary between maintaining a budget that fails to keep up with inflation (coded as 1) and experiencing substantial budget cuts (also coded as 1). While I acknowledge these concerns, this scheme is appropriate to test my theoretical arguments: politicians may reduce agency budgets as a signal to demand

improved performance, and for this purpose, the cut does not need to be substantial. Even maintaining a budget without adjustments for inflation can convey discontent to the agency.

I control for several, potentially confounding factors. First, I include antitrust investigation conducted by the AD to account for the supply side of regulation enforcement. To address the time lag from investigation to litigation, I use lagged terms for these investigation proportions of each case type but exclude one component (non-merger civil investigations) from the right hand side to avoid issues of perfect collinearity (Adolph, 2013). The results remain robust when using investigation proportions from the same year and when excluding different components. Next, I include the professional composition in the AD, measured by the ratio of economists to attorneys. This variable reflects the influence of professional norms on regulatory decisions (Katzman, 1981; Eisner and Meier, 1990). For instance, different professions may prioritize different types of antitrust cases. Additionally, the professional composition can be associated with the agency's budget, as hiring more economists typically requires greater financial resources.

Furthermore, I include a set of political variables, such as presidential partisanship and the appointment of the agency head. Both are dummy variables: the value of presidential partisanship is 1 in the year when the president is a Democrat. The value of head appointment is 1 in the year when the Assistant Attorney General of the AD is appointed. These variables can confound the relationship. The president may have preferences on federal agencies' budgets and antitrust enforcement associated with her or his partisanship and seek to achieve her or his policy goals through political appointments (Stewart Jr and Cromartie, 1982; Wood and Anderson, 1993). Fourth, I control for macroeconomic variables, such as inflation and unemployment rates. A national economy may confound the relationship of interest in that, during an economic downturn, the federal government may simultaneously cut federal agencies' budgets and ease antitrust enforcement to boost the economy (Amacher et al., 1985). Refer to the Appendix for summary statistics.

Compositional and Temporal Specifications

I employ a dynamic compositional analysis to model how the AD navigates trade-offs between different antitrust regulations. Like most public organizations, the AD operates within the limitations in human and financial resources. However, given that the regulated entities are typically big, resourceful private firms, the agency is bound with more severe constraints. It implies the potential for prioritizing one type of regulation to impact the enforcement of others. To address this issue, we should incorporate interdependencies between enforcement decisions into the analysis, ensuring unbiased estimates.

It is important to clarify that my theoretical claims focus on enforcement priority shifts, as reflected in relative changes in regulatory components, rather than changes in their absolute levels. While budget reductions often result in a decrease in the total amount of enforcement, the impact on a particular regulation may depend on its prioritization and the extend of the budget cut. The absolute level of enforcement for the specific regulation can decrease, remain stable, or even increase. Given that, conventional methods such as count outcome analysis may not produce meaningful insights. In contrast, the dynamic compositional model allows researchers to solely focus on relative changes in different regulatory components, thus providing a more nuanced understanding of how budgetary changes affect enforcement priorities (Philips, Rutherford and Whitten, 2016*a*).

This compositional analysis offers advantages in modeling trade-offs among different components through two key features: (1) it uses the log ratios of each component relative to a baseline component as dependent variables, and (2) it employs seemingly unrelated regression (SUR) to account for contemporaneous correlations in the errors across equations. Mathematically, this is expressed as:

$$s_{it} = \ln \frac{y_{it}}{y_{1t}}, \quad \forall \ i \neq 1,$$

where y_{it} is the percentage of component i in the overall composition at time t, y_{1t} refers to the percentage of the baseline component 1 at time t, and s_{it} the log-ratio of component

i to the baseline component at time t.

The model can be further expressed as:

$$s_{it} = \beta_{0i} + \alpha_i s_{it-1} + \boldsymbol{\beta}_i \boldsymbol{X}_t + \boldsymbol{\Sigma}_{it},$$

where α_i is the effect of the lagged dependent variable, $\boldsymbol{X}_t$ is a vector of independent variables values at time t, $\boldsymbol{\beta}_i$ is a vector of short-run effects, and $\boldsymbol{\Sigma}_t$ is a matrix of error terms that may be correlated across the $I-1$ equations. Based on this expression, the long-run effects can be calculated as $\frac{\beta_i}{1-\alpha_i}$ (De Boef and Keele, 2008).

There are two main reasons for using the log-ratio transformation for dependent variables (Aitchison, 1982). First, using ratios helps avoid the unrealistic assumption that changes in each component of a composition are independent of changes in the other components. If percentages of a single component were analyzed in isolation, it would be difficult to capture how changes in that component is associated with others. Second, the log transformation enables linear modeling by converting percentages from a constrained compositional space (ranging between zero and one) to the unconstrained real plane (Aitchison, 1986; Katz and King, 1999).

Furthermore, the SUR approach allows for residuals to be correlated across all equations, reflecting the assumption that stochastic terms influencing decisions in one component may also influence others (Tomz, Tucker and Wittenberg, 2002). With these specifications, the compositional analysis provides comprehensive insights into trade-offs between different components.

To address temporal dependencies in case-load decisions, I include a lag of the dependent variable in the model. The lagged term accounts for the tendency that public agencies establish the yearly plan based on the previous year's policy implementation. Additionally, I conducted a series of unit root and stationarity tests to assess the stability of the variables. For variables suspected of being non-stationary, such as the ratio of economists to attorneys, inflation and unemployment rates, I differenced them to achieve stationarity. To avoid the risk of spurious regression outcomes, I also included a time-trend variable on the right-hand side of the regression equations. Note that the regression

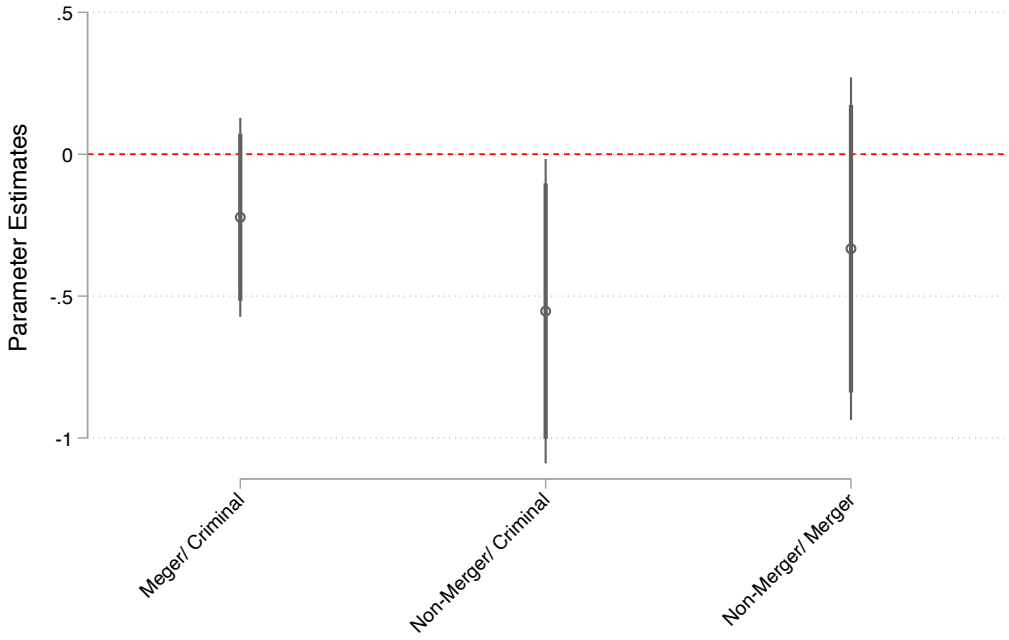


Figure 4: Parameter Estimates of Budget Reduction from the Main Model.

results are robust without the trend term.

Findings

Main Results

In Figure 4, I present parameter estimates of budget reduction on the log ratios of antitrust litigation. Each estimate is derived from a separate regression with a different log ratio as the dependent variable, thus indicating how budget reductions influence the proportion of one antitrust component to another. Thicker lines and thinner lines indicate 90% and 95% confidence intervals of estimates, respectively. If a confidence interval does not intersect the red dashed line, the corresponding parameter estimate is statistically different from zero. The full results are detailed in Table B.2 in the Appendix.

Among the results, the coefficient on the log ratio of non-merger civil cases to criminal cases is statistically significant and negative at the 95% confidence level. This suggests that, in the short run, the AD responds to budget cuts by increasing the proportion of criminal cases (the denominator of the log ratio) in its litigation portfolio, while reducing

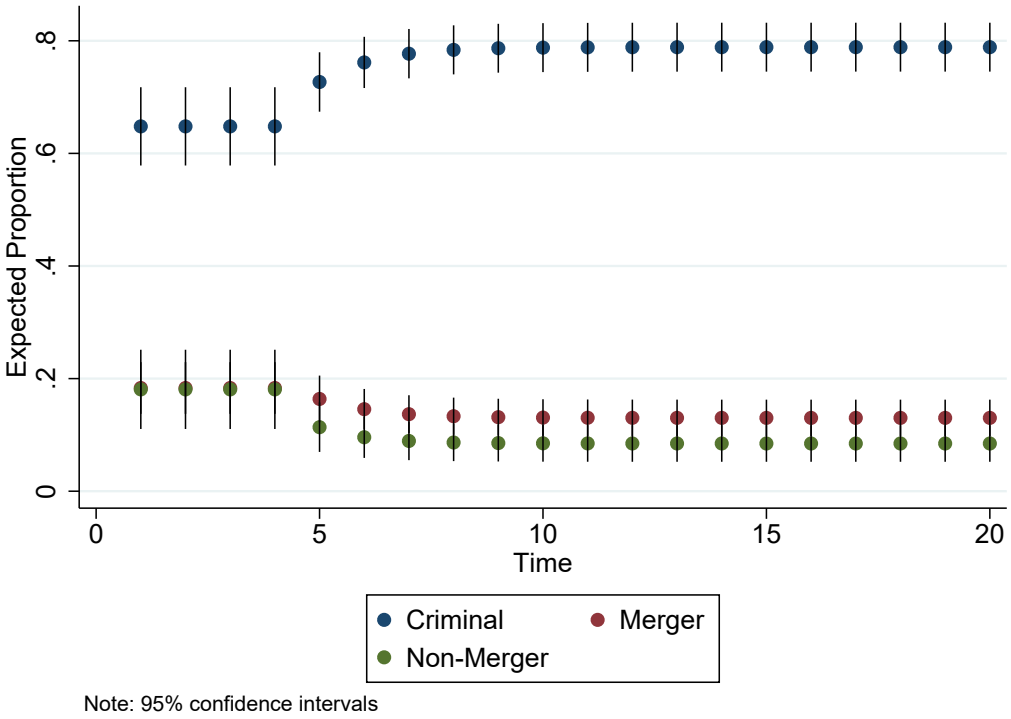


Figure 5: Simulation Results of Expected Proportional Changes from the Baseline.

the proportion of non-merger civil cases. In other words, the AD prioritizes criminal litigation over non-merger civil one when faced with more constrained budgets.

To further explore the substantial implications, I simulated expected proportional changes from the baseline (Figure 5). Drawn from the main results (Table B.2), I generated 1,000 sets of parameter estimates with the Stata package Clarify (Tomz, Wittenberg and King, 2003). Then, I calculated first-year baseline compositions using these parameter estimates, sample-mean values of continuous variables, and zero values of dummy variables included in the model. These baseline values were reintroduced into the equations as the values of lagged dependent variable for time $t = 2$, repeating the process up to $t = 5$.

At time $t = 5$, I introduced a hypothetical shock by changing the value of the budget reduction variable from 0 to 1, simulating a scenario in which the AD's budget decreases while all other factors remain constant. The process of calculation was repeated for subsequent time points to examine how the AD's litigation portfolio evolves over time. In Figure 5, the confidence intervals represent the 95% of the distribution of the simulated

results, predicted values of each composition given specific parameter estimates.[19] Blue, red, and green dots indicate the predicted litigation proportions of criminal, merger, and non-merger civil cases, respectively.

Two primary things are noteworthy from the simulation results. First, whereas the increase in criminal litigation comes with the sacrifice of non-merger civil litigation in the short term (at $t = 5$), the AD further reallocates resources to criminal cases at the expense of merger litigation in the long term. This lagged effect on merger litigation may be attributable to the rigid nature of the merger review process, where the AD is required to address all transactions notified prior to their consummation.

Second, the effects of budget reductions on the AD's litigation compositions are substantial. At baseline, the expected litigation proportions for criminal, merger, and non-merger civil cases are approximately 65%, 17.5%, and 17.5% of the total composition, respectively. When a budget reduction occurs at time $t = 5$, the proportion of criminal cases is expected to contemporaneously increase by approximately 7%. Over time, the litigation proportion of criminal cases continues to rise, ultimately reaching about 78% of the total composition. These results indicate that in response to a budget reduction, the AD is expected to significantly increase its focus on criminal litigation in the long run.

Slice the Pie Differently

The dynamic compositional analysis can yield sensitive estimates and implications depending on how the overall composition is divided into its components. This sensitivity arises because different categorizations change the log ratios of components, which serve as the dependent variables in the estimations. Therefore, researchers employing the dynamic compositional model are advised to assess the robustness of their result by testing alternative categorizations of the composition.

I now classify the AD's litigation into four components: antitrust criminal cases, other criminal cases, merger cases, and non-merger civil cases. The category of other criminal

[19]For details in this hypothetical simulation, *see* Philips, Rutherford and Whitten (2016*b*); Jung et al. (2020).

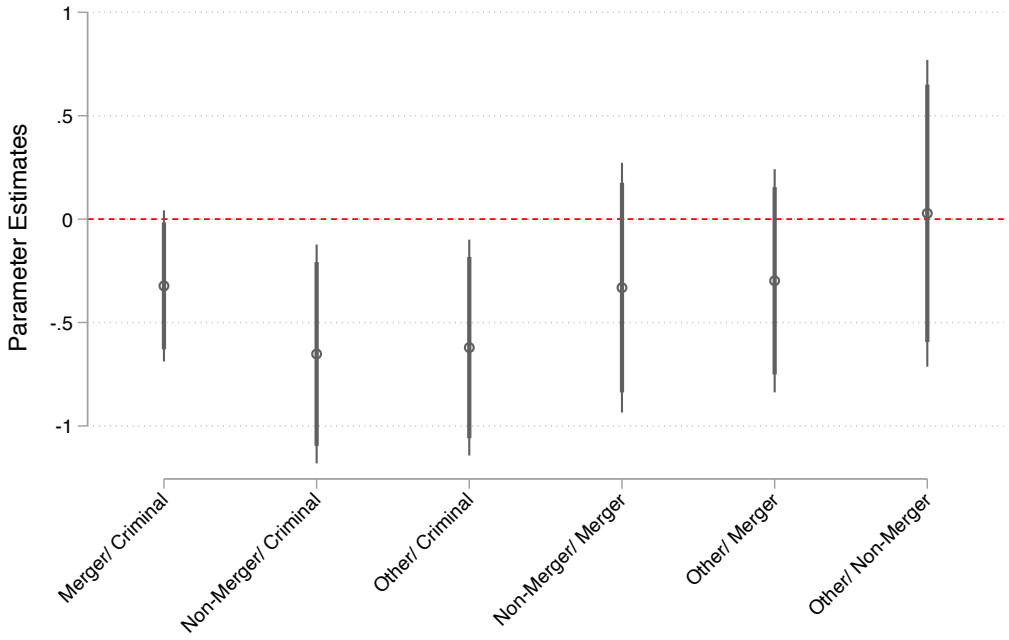


Figure 6: Parameter Estimates of Budget Reduction from the Different Categorization.

cases includes litigation involving federal crimes unrelated to antitrust regulations, such as perjury, mail fraud, contempt, obstruction of justice, and false statements.[20] Since these cases are unrelated to antitrust matters, the *per se* rule does not apply.

According to my theoretical claim, public agencies respond to budget reductions by focusing on more efficient tasks to improve their performance metrics. Given that the *per se* rule provides certainty in the conviction of antitrust criminal cases, we should expect a budget reduction to increase the litigation proportion of antitrust criminal cases. However, this effect should not extend to other criminal cases, which lack the procedural efficiencies afforded by the *per se* rule.

As shown in Figure 6, the results remain robust under this refined categorization of antitrust litigation. The parameter estimates for budget reductions are statistically significant and negative at the 95% confidence level for the log ratios of (1) non-merger civil to antitrust criminal cases and (2) other criminal to antitrust criminal cases. Additionally, the effect of budget reduction on the log ratio of merger to antitrust criminal

[20]For more details on other criminal cases, see *Antitrust Law Developments* (2017), page 953.

	Mean of Failure Rates			
	Increase	Decrease	Difference	p-value
Criminal	0.069	0.063	0.005	0.410
	(0.020)	(0.009)	(0.024)	
Antitrust	0.062	0.062	0.000	0.501
	(0.020)	(0.011)	(0.024)	
Others	0.080	0.066	0.014	0.363
	(0.029)	(0.021)	(0.019)	
Merger	0.105	0.062	0.043	0.120
	(0.026)	(0.023)	(0.036)	
Non-Merger	0.053	0.046	0.007	0.397
	(0.022)	(0.165)	(0.027)	
All Cases	0.061	0.060	0.001	0.478
	(0.012)	(0.008)	(0.015)	
N	28	22		

Note: Standard errors are reported in the parenthesis.

Table 2: t-tests Comparing the Difference in Means of Failure Rates.

cases becomes significant and negative at the 90% confidence level, which is adequate for testing directional hypotheses.

These findings suggest that the AD strategically prioritizes antitrust criminal cases over other types, even within the category of criminal litigation. Only in antitrust criminal cases is the *per se* rule applied, making this type the most certain and efficient way to secure a conviction. When budgets are reduced, the AD thus reallocates resources to focus more on antitrust criminal cases, even if it means diverting resources from other criminal cases. This refined categorization, grounded in my theoretical claims, not only aligns with the main findings but also enhances the efficiency of the estimates. For further details, refer to the Appendix, which includes the regression table (Table B.3) and cumulative plot of the simulation results (Figure B.3) for this model.

Performance Motivation and Within-Case Prioritization

In this section, I assess the validity of the causal mechanism underlying my theory. Until now, my theoretical claims and empirical tests have focused on the AD's strategic decisions across case types, arguing that the AD prioritizes the most efficient cases, i.e., antitrust criminal cases, when having more constrained budgets. However, if the AD's

primary motivation is to enhance performance metrics, these strategic case-load decisions should also manifest within each case type. In other words, the AD would strategically select and pursue winnable cases even within the same category of litigation. If this is a case, we should observe significantly lower failure rates for cases initiated during years of budget reductions compared to those initiated in years when the budget remains stable or increases, within the same case types.

In Table 2, I present the results of a mean-difference test for failure rates across different case types, using the p-value from a one-tailed hypothesis test. The failure rate is calculated by dividing the number of lost cases by the total number of terminated cases within a fiscal year. Terminated cases include those litigated to judgment in district court, cases resolved through negotiated settlements entered by the district court, and cases administratively dismissed after the parties addressed competitive concerns through abandonment or negotiated settlement. In contrast, lost cases specifically refer to those resulting in a judgment against the AD in district court.

Note that although the mean failure rates for years with increased budgets are higher than those for years with decreased budgets, the differences are statistically insignificant across all case types. This lack of significance could be attributed to several factors. First, the number of observations may be too small to detect meaningful differences. Second, the calculation of failure rates includes cases terminated within the fiscal year, regardless of when they were initially filed, potentially diluting the temporal association with budget changes. Third, some cases can be dropped before reaching a judgment due to agreements made between made between the parties.

Nevertheless, the mean differences in failure rates for merger and antitrust criminal cases are noteworthy, as they represent the highest and lowest p-values, respectively, among all case types. On the one hand, merger cases exhibit the highest mean difference, with a p-value of 0.120, suggesting that strategic selection is most pronounced within this case type. Combined with the estimated short- and long-run effects on merger litigation, this finding implies that the AD responds to budget reductions by (1) selectively pursuing winnable merger cases while maintaining the scale of merger litigation in the short term,

and (2) reducing the overall scale of merger litigation in the long term.

On the other hand, no significant difference in failure rates is observed for antitrust criminal cases between years with increased and decreased budgets. This indicates that the AD does not particularly engage in more selective case decisions within antitrust criminal cases under budget constraints. This lack of variation may be explained by the *per se* rule, which provides reliable predictions for convictions, allowing the AD to selectively pursue antitrust criminal cases even in years with sufficient financial resources. Instead of further refining case selection within antitrust criminal cases, the AD responds to budget cuts by increasing the litigation proportion of antitrust criminal cases within its overall portfolio.

Granger-Cause Tests for Reverse Causality

	Non-merger/ Criminal		Merger/ Criminal		Non-merger/ Merger	
	χ^2	df	χ^2	df	χ^2	df
Litigation equation budget	5.760*	1	0.212	1	3.159*	1
Budget equation litigation	0.009	1	0.055	1	0.002	1

Note: $^*p$ <0.1

Table 3: Granger-Causality Tests.

Some may raise concerns about potential endogeneity: the causality between budgetary changes and the AD's litigation portfolio decisions might be reversed and this reversed relationship might drive the regression results. To address this issue, I perform Granger-causality tests to examine the temporal relationship between the AD's budget and litigation compositions. According to Granger (1969), a variable y_1 is said to "Granger-cause" another variable y_2 if the inclusion of lags of both y_1 and y_2 significantly improves the prediction of future values of y_2, compared to using lags of y_2 alone. To determine whether each variable Granger-cause another, I conduct Wald test that examine whether lagged values of y_1 provide significant improvement in predicting y_2, beyond the information already contained in the lagged values of y_2 itself, *vice versa*.

Importantly, to account for the temporal sequence in which budget appropriations are

always made before case-load decisions in the same fiscal year, I employ a structural vector autoregression (SVAR) model instead of using a reduced form of vector autoregression (VAR). This model includes only the contemporaneous effect of budget reductions on antitrust litigation compositions. Mathematically, this SVAR(1) model can be expressed as:

$$
\begin{aligned}
b_t &= \alpha_1 + \qquad \boldsymbol{\rho}_1 \boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_1 \boldsymbol{Z}_t + u_{1t}, \\
s_t &= \alpha_2 + \beta_2 b_t + \boldsymbol{\rho}_2 \boldsymbol{Y}_{t-1} + \boldsymbol{\beta}_2 \boldsymbol{Z}_t + u_{2t},
\end{aligned}
$$

where b_t is a budget reduction at time t, s_t is the litigation ratio at time t, $\boldsymbol{Y}_t \equiv (b_t, s_t)'$, and $\boldsymbol{\rho}_j$ is a 2-dimensional row vector for all j. The term of $\boldsymbol{Z}_t$ indicates a set of exogenous variables in the equation.

In Table 3, I present the results of the Granger-causality tests. Separate models are estimated for each litigation ratio. Each column corresponds to results from models using the ratios of non-merger civil to criminal cases, merger to criminal cases, and non-merger civil to merger cases, respectively.

In the litigation equations, I test whether the coefficient of a contemporaneous budget reduction on the litigation ratios is zero. The null hypothesis—that a budget reduction does not Granger-cause the AD's litigation decisions – can be rejected for the ratios of non-merger civil to criminal cases and non-merger civil to merger cases at the 90% confidence level. These results support the hypothesis that the AD strategically adjusts its litigation portfolio to enhance performance under budget constraints.

In the budget equations, I examine whether the lagged litigation ratios influence the agency's budget. The null hypothesis – that litigation compositions do not Granger-cause the agency's budget – cannot be rejected. In a nutshell, while budget reductions Granger-cause changes in the AD's litigation portfolio, the reverse is not true.

What a Count Outcome Analysis Does Not Tell

Public agencies anticipating budget cuts often downsize their programs, consolidate offices, and reduce staff (Aragão and Fontana, 2022; Kazho and Atan, 2022). For instance, in response to significant budget reductions under the Obama administration in 2011, the AD closed its regional offices in Atlanta, Cleveland, Dallas, and Philadelphia. This downsizing led to the loss of qualified personnel, limiting the agency's capacity to address violations effectively and serve the public interest.[21] Given these realities, it might seem paramount to analyze the impacts of budget reductions on regulatory enforcement in absolute terms.

However, I argue that count outcome analysis, while important, can overlook critical insights into bureaucratic responses to budgetary constraints. In this section, I compare the findings of count outcome analysis with the results of main compositional model to illustrate the implications that might otherwise be missed. In count outcome analysis, I include count variables for each type of prosecution and investigation in the model, instead of their ratios. Then, I employ seemingly unrelated regression (SUR) to account for correlated error terms across equations. I include the same set of explanatory variables in the model. Results are presented in Table B.4 in the Appendix.

The main independent variable – budget reduction – has a statistically significant, negative effect only on the number of non-merger civil cases, at the 95% confidence level, whereas its effects on criminal and merger cases are estimated as insignificant. These results suggests that, in the short term, the AD reduces the absolute number of non-merger civil cases while maintaining the enforcement levels for other types of cases. Such findings emphasize the importance of modeling the entire composition together. Without this approach, one might observe that the AD sacrifices non-merger civil enforcement in response to budget cuts, but would fail to identify which type of case is prioritized in exchange.

[21] *See* `https://www.washingtonpost.com/blogs/federal-eye/post/justice-department-lawyers-irked-by-plans-to-close-offices/2011/10/17/gIQAzZ7EsL_blog.html`.

Conclusions

Public agencies frequently contend with resource shortages relative to the scope of their programs and responsibilities, requiring careful allocation of their limited resources across various tasks. The need for strategic case-load decisions becomes even more pronounced when politicians impose budget cuts. To regain their funding, agencies must enhance their performance metrics to demonstrate competency, while still carrying out existing responsibilities and fulfilling their original missions.

In this paper, I propose a theory of strategic task portfolios that explains how public agencies react to budgetary control. I argue that public agencies strategically adjust their priorities based on budgetary constraints: under reduced budgets, agencies prioritize improving performance metrics; with affluent resources, they refocus on fulfilling their original missions. Accordingly, my theoretical model hypothesizes that public agencies respond to budget reductions by reallocating resources to increase the proportion of efficient tasks within their task portfolios.

To test my theoretical claims, I employ the dynamic compositional analysis using original data of antitrust litigation filed by the AD from 1970 to 2019. As anticipated, I find that the AD strategically restructure its litigation portfolios based on budgetary constraints. Specifically, in response to budget cuts, the AD increases the proportion of antitrust criminal cases – the most efficient type of cases to improve antitrust performance metrics – within its litigation portfolio, at the expense of other types of cases. These findings are robust across various checks, confirming the agency's strategic priority shifts responding to budgetary changes.

The theoretical arguments extend beyond the antitrust context to other regulatory agencies overseeing specialized areas with substantial discretion (such as the Food and Drug Administration, the Environmental Protection Agency, the Federal Bureau of Investigation, etc.). Similar to the AD, these agencies operate under resource constraints while seeking to uphold professional standards. To secure additional resources for future regulatory enforcement, they often need to demonstrate competency. Driven by this motivation, such agencies may strategically structure and reshape their task portfolios

to balance the competing goals of improving performance metrics and achieving their original missions.

Contrary to conventional wisdom, this shift in priorities does not reflect bureaucratic unaccountability or incompetence. Rather, it underscores the strategic decision-making of bureaucrats in determining the timing of policy implementation (Carpenter, 2002; Potter, 2017). With longer tenures compared to elected counterparts, bureaucrats possess greater flexibility to delay or expedite policy-making processes depending on a current political climate. In this paper, I highlight how bureaucrats selectively focus on efficient works to shape favorable political conditions for future policy implementation.

Therefore, this paper broadens our understanding of bureaucratic responses to political cues by focusing on how agencies adapt to short-term budgetary changes. Previous research has largely emphasized long-term strategies employed by bureaucrats. For instance, agencies may gain expertise and build reputation to achieve autonomy in policy decisions (Carpenter, 2001), or delay rule-making until unfavorable elected officials are replaced in subsequent elections (Potter, 2017). However, as budget appropriations occur on an annual basis, these long-term strategies may be less effective in addressing immediate budgetary shifts – one of the most common tools for political control over bureaucracy. This paper demonstrates how public agencies strategically respond to short-term budget changes to pursue their preferred policies effectively.

While a significant body of literature attributes the influence of the Chicago School as a major factor driving the surge in mergers and acquisitions, subsequently leading to increasingly concentrated markets since the 1970s (Eisner and Meier, 1990; Eisner, 1991; Cucinotta, Pardolesi and van den Bergh, 2002; Philippon, 2019), this paper aligns with a growing body of research that highlights the role of unelected officials in the decline of antitrust policy enforcement. For instance, Lancieri, Posner and Zingales (2022) contend that amid a legal trend favoring weakened structural antitrust enforcement, antitrust agencies facing severe resource constraints have been compelled to prioritize easier-to-prosecute cases. This focus, in turn, exacerbates the decline in substantive enforcement against structural cases.

Nevertheless, my paper underscores that the shift in antitrust priorities cannot be solely interpreted as unaccountability on the part of antitrust regulators. Empirically, I find that budget reductions have statistically significant effects on antitrust litigation portfolios. This finding does not suggest that the AD always seeks to maximize performance ratings by pursuing criminal cases, irrespective of its available resources. Instead, it indicates that the agency strategically prioritize different, but competing goals depending on its resource constraints. Only when the agency faces with resource shortages due to recent budget cuts, does it shift its focus to more efficient tasks. By doing so, the antitrust agency aims to improve performance metrics, demonstrate competency, and advocate for increased budgets to support future policy implementation.

In conclusion, I offer valuable insights into how public agencies navigate their diverse responsibilities with limited resources. Agencies may adjust their priorities and restructure their task portfolios accordingly. While this study focuses on changes in public task portfolios driven by budget cuts, the priority shifts are also likely influenced by other factors, such as incumbent partisanship, pressures from interest groups, and policy salience. Future research could explore these dynamics for a better understanding of public case-load decisions. Additionally, for regulation enforcement to be aligned with the public interest, it is essential to acknowledge legal and institutional contexts within which bureaucrats operate and to develop stronger incentive mechanisms that effectively encourage bureaucrats to achieve their original goals and missions.

References

Adolph, Christopher. 2013. Central Banker Careers and Inflation in Industrial Democracies. In *Bankers, Bureaucrats, and Central Bank Politics: The Myth of Neutrality*. Cambridge Studies in Comparative Politics Cambridge University Press pp. 70–115.

Aitchison, John. 1982. "The Statistical Analysis of Compositional Data." *Journal of the Royal Statistical Society: Series B (Methodological)* 44(2):139–160.

Aitchison, John. 1986. *The Statistical Analysis of Compositional Data*. London: Chapman and Hall.

Alesina, Alberto and Guido Tabellini. 2008. "Bureaucrats or Politicians? Part II: Multiple Policy Tasks." *Journal of Public Economics* 92(3-4):426–447.

Amacher, Ryan, Richard Higgins, William Shughart Ii and Robert Tollison. 1985. "The Behavior of Regulatory Activity over the Business Cycle: An Empirical Test." *Economic Inquiry* 23(1):7–19.

Anderson, Derrick M. and Justin M. Stritch. 2016. "Goal Clarity, Task Significance, and Performance: Evidence From a Laboratory Experiment." *Journal of Public Administration Research and Theory* 26(2):211–225.

Aragão, João Paulo Santos and Marcele Elisa Fontana. 2022. "Outsourcing Strategies in Public Services under Budgetary Constraints: Analysing Perceptions of Public Managers." *Public Organization Review* 22(1):61–77.

Banks, Jeffrey S. and Barry R. Weingast. 1992. "The Political Control of Bureaucracies under Asymmetric Information." *American Journal of Political Science* 36(2):509–524.

Bohte, John and Kenneth J. Meier. 2000. "Goal Displacement: Assessing the Motivation for Organizational Cheating." *Public Administration Review* 60(2):173–182.

Bork, Robert H. 1978. *The Antitrust Paradox*. Basic books New York.

Brehm, John and Scott Gates. 1999. *Working, Shirking, and Sabotage: Bureaucratic Response to a Democratic Public*. University of Michigan Press.

Carpenter, Daniel P. 1996. "Adaptive Signal Processing, Hierarchy, and Budgetary Control in Federal Regulation." *American Political Science Review* 90(2):283–302.

Carpenter, Daniel P. 2000. "State Building through Reputation Building: Coalitions of

Esteem and Program Innovation in the National Postal System, 1883–1913." *Studies in American Political Development* 14(2):121–155.

Carpenter, Daniel P. 2001. *The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1928*. Vol. 78 Princeton University Press.

Carpenter, Daniel P. 2002. "Groups, the Media, Agency Waiting Costs, and FDA Drug Approval." *American Journal of Political Science* 46(3):490–505.

Carpenter, Daniel P. 2010. *Reputation and Power: Organizational Image and Pharmaceutical Regulation at the FDA*. Princeton University Press.

Carrier, Michael A. 2019. "The Four-Step Rule of Reason." *Antitrust* 33:50.

Chen, Jia, Yuan Yang and Jinhai Yu. 2024. "Task Complexity, Organizational Size, and Performance: An Examination of the U.S. State Budget Agencies." *Public Management Review* 26(4):837–862.

Chun, Young Han and Hal G. Rainey. 2005. "Goal Ambiguity and Organizational Performance in U.S. Federal Agencies." *Journal of Public Administration Research and Theory* 15(4):529–557.

Connolly, Robert E. 2020. "In the Clash Between the Venerable Per Se Rule and the Constitution, the Constitution Shall Prevail (In Time)." *Competition* 30(1):117–136.

Cucinotta, Antonio, Roberto Pardolesi and Roger van den Bergh, eds. 2002. *Post-Chicago Developments in Antitrust Law*. New Horizons in Law and Economics Cheltenham, UK ; Northampton, MA: Edward Elgar.

De Boef, Suzanna and Luke Keele. 2008. "Taking Time Seriously." *American Journal of Political Science* 52(1):184–200.

De Mesquita, Ethan Bueno and Matthew C. Stephenson. 2007. "Regulatory Quality Under Imperfect Oversight." *American Political Science Review* 101(3):605–620.

Demsetz, Harold. 1974. Two Systems of Belief about Monopoly. In *Industrial Concentration: The New Learning*, ed. Harvey J. Goldschmid, H. Michael Mann and H. Fred Weston. Boston: Little, Brown.

Dewatripont, Mathias and Ian Jewitt. 1999. "The Economics of Career Concerns, Part

I: Comparing Information Structures." *REVIEW OF ECONOMIC STUDIES* p. 16.

Eisner, Marc Allen. 1991. *Antitrust and the Triumph of Economics: Institutions, Expertise, and Policy Change*. UNC Press Books.

Eisner, Marc Allen and Kenneth J Meier. 1990. "Presidential Control versus Bureaucratic Power: Explaining the Reagan Revolution in Antitrust." *American Journal of Political Science* 34(1):269–287.

Gilmour, John B. and David E. Lewis. 2006. "Assessing Performance Budgeting at OMB: The Influence of Politics, Performance, and Program Size." *Journal of Public Administration Research and Theory* 16(2):169–186.

Granger, Clive W. J. 1969. "Investigating Causal Relations by Econometric Models and Cross-spectral Methods." *Econometrica: Journal of the Econometric Society* 37(3):424–438.

Holmstrom, Bengt and Paul Milgrom. 1991. "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design." *Journal of Law, Economics, and Organization* 7:24–52.

Hovenkamp, Herbert J. 2018. "The Rule of Reason." *Florida Law Review* 70.

Huizinga, Kees and Martin de Bree. 2021. "Exploring the Risk of Goal Displacement in Regulatory Enforcement Agencies: A Goal-Ambiguity Approach." *Public Performance & Management Review* 44(4):868–898.

Jung, Yoo Sun, Flávio DS Souza, Andrew Q Philips, Amanda Rutherford and Guy D Whitten. 2020. "A Command to Estimate and Interpret Models of Dynamic Compositional Dependent Variables: New Features for Dynsimpie." *The Stata Journal* 20(3):584–603.

Katz, Jonathan N. and Gary King. 1999. "A Statistical Model for Multiparty Electoral Data." *American Political Science Review* 93(1):15–32.

Katzman, Robert A. 1981. *Regulatory Bureaucracy: The Federal Trade Commission and Antitrust Policy*. The MIT Press.

Kazho, Shahram Ali and Tarik Atan. 2022. "Public Sector Downsizing and Public Sector Performance: Findings from a Content Analysis." *Sustainability* 14(5):2989.

Konisky, David M. and Manuel P. Teodoro. 2016. "When Governments Regulate Governments." *American Journal of Political Science* 60(3):559–574.

Lancieri, Filippo, Eric A. Posner and Luigi Zingales. 2022. "The Political Economy of the Decline of Antitrust Enforcement in the United States.".

McCubbins, Mathew D and Thomas Schwartz. 1984. "Congressional Oversight Overlooked: Police Patrols versus Fire Alarms." *American Journal of Political Science* 28(1):165–179.

Meier, Kenneth J. and Laurence J. O'Toole. 2006. "Political Control versus Bureaucratic Values: Reframing the Debate." *Public Administration Review* 66(2):177–192.

Niskanen, William A. 1971. *Bureaucracy and Representative Government*. Aldline Press.

Patty, John W. 2024. "Working Towards Policy: A Theory of Organizational Implementation and Management." *Journal of Public Administration Research and Theory* 34(1):53–66.

Philippon, Thomas. 2019. *The Great Reversal: How America Gave Up on Free Markets*. Belknap Press.

Philips, Andrew Q, Amanda Rutherford and Guy D Whitten. 2016*a*. "Dynamic Pie: A Strategy for Modeling Trade-offs in Compositional Variables over Time." *American Journal of Political Science* 60(1):268–283.

Philips, Andrew Q, Amanda Rutherford and Guy D Whitten. 2016*b*. "Dynsimpie: A Command to Examine Dynamic Compositional Dependent Variables." *The Stata Journal* 16(3):662–677.

Potter, Rachel Augustine. 2017. "Slow-Rolling, Fast-Tracking, and the Pace of Bureaucratic Decisions in Rulemaking." *The Journal of Politics* 79(3):841–855.

Rasul, Imran, Daniel Rogger and Martin J Williams. 2021. "Management, Organizational Performance, and Task Clarity: Evidence from Ghana's Civil Service." *Journal of Public Administration Research and Theory* 31(2):259–277.

Ringquist, Evan J. 1995. "Political Control and Policy Impact in EPA's Office of Water Quality." *American Journal of Political Science* 39(2):336.

Rudalevige, Andrew. 2021. *By Executive Order: Bureaucratic Management and the Lim-*

its of Presidential Power. Princeton University Press.

Schinkel, Maarten Pieter, Lukáš Tóth and Jan Tuinstra. 2020. "Discretionary Authority and Prioritizing in Government Agencies." *Journal of Public Administration Research and Theory* 30(2):240–256.

Srinivasan, Dina. 2019. "The Antitrust Case Against Facebook: A Monopolist's Journey Towards Pervasive Surveillance in Spite of Consumers' Preference for Privacy." *Berkeley Bus. LJ* 16:39.

Stewart Jr, Joseph and Jane S Cromartie. 1982. "Partisan Presidential Change and Regulatory Policy: The Case of the FTC and Deceptive Practices Enforcement, 1938—1974." *Presidential Studies Quarterly* 12(4):568–573.

Ting, Michael M. 2001. "The "Power of the Purse" and Its Implications for Bureaucratic Policy-Making." *Public Choice* 106(3):243–274.

Ting, Michael M. 2002. "A Theory of Jurisdictional Assignments in Bureaucracies." *American Journal of Political Science* 46(2):364.

Ting, Michael M. 2003. "A Strategic Theory of Bureaucratic Redundancy." *American Journal of Political Science* 47(2):274–292.

Tomz, Michael, Jason Wittenberg and Gary King. 2003. "Clarify: Software for Interpreting and Presenting Statistical Results." *Journal of Statistical Software* 8(1):1–30.

Tomz, Michael, Joshua A. Tucker and Jason Wittenberg. 2002. "An Easy and Accurate Regression Model for Multiparty Electoral Data." *Political Analysis* 10(1):66–83.

Tucker, Darren S., Robert E. Bloch, Noah A. Brumfield, Robert Mahini, Kimberley Piro, Stuart C. Plunkett and Shelly J. Webb, eds. 2017. *Antitrust Law Developments (Eighth Edition)*.

Waller, Spencer Weber. 2012. "Antitrust and Social Networking." *North Carolina Law Review* 90:1771.

Weingast, Barry R. and Mark J. Moran. 1983. "Bureaucratic Discretion or Congressional Control? Regulatory Policymaking by the Federal Trade Commission." *Journal of Political Economy* 91(5):765–800.

Weiss, Leonard W. 1978. "Structure-Conduct-Performance Paradigm and Antitrust."

University of Pennsylvania Law Review 127:1104.

Wildavsky, Aaron B. 1986. *Budgeting: A Comparative Theory of the Budgeting Process.* Routledge.

Wilson, James Q. 1989. *Bureaucracy: What Government Agencies Do and Hy They Do It.* Basic Books.

Wood, B Dan and James E Anderson. 1993. "The Politics of U.S. Antitrust Regulation." *American Journal of Political Science* 37(1):1–39.

Wood, B. Dan and Richard W. Waterman. 1991. "The Dynamics of Political Control of the Bureaucracy." *American Political Science Review* 85(3):801–828.

Wood, B Dan and Richard W Waterman. 1993. "The Dynamics of Political-Bureaucratic Adaptation." *American Journal of Political Science* 37(2):497–528.

Yoo, Christopher S. 2012. "When Antitrust Met Facebook." *George Mason Law Review* 19:1147.

Supplementary Material

For online publication only.

Contents

A Empirical Case: the U.S. Anti-trust Division

A.1 *Congressional Submission FY 2021 Performance Budget*

3. Performance Measurement Framework

Antitrust Division, Department of Justice

Performance Measurement Framework
FY 2021

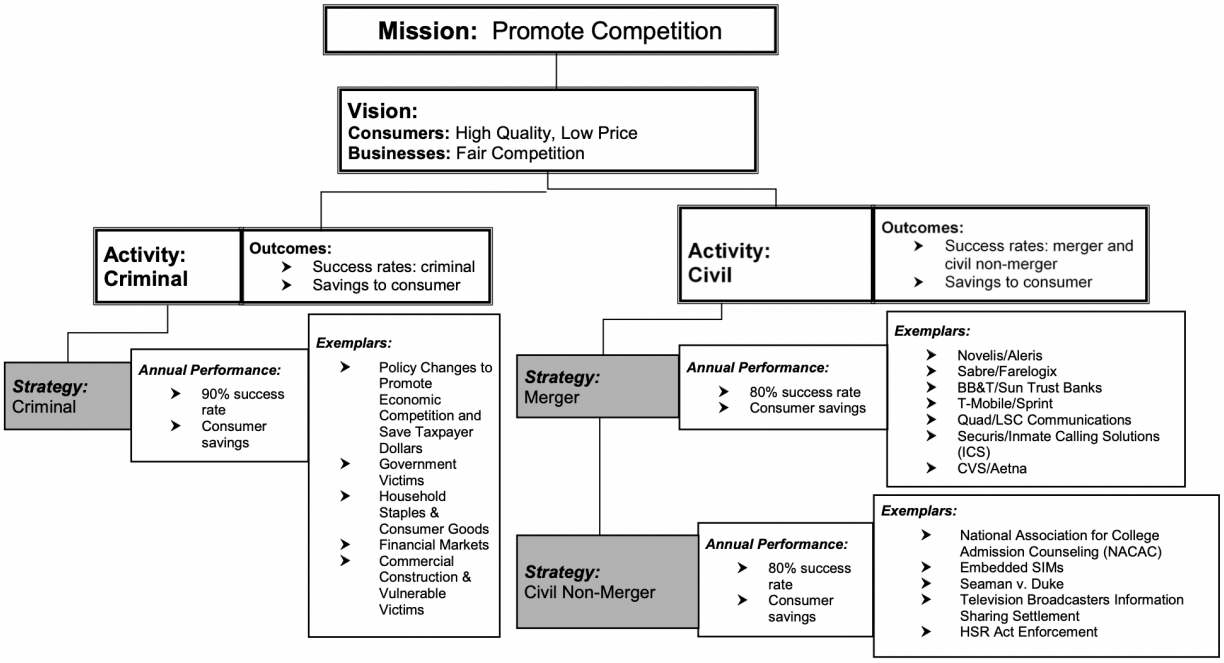


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Figure A.1: Anti-trust Division 2021 Performance Goals, Page 29

B Statistical Analysis

B.1 Summary Statistics

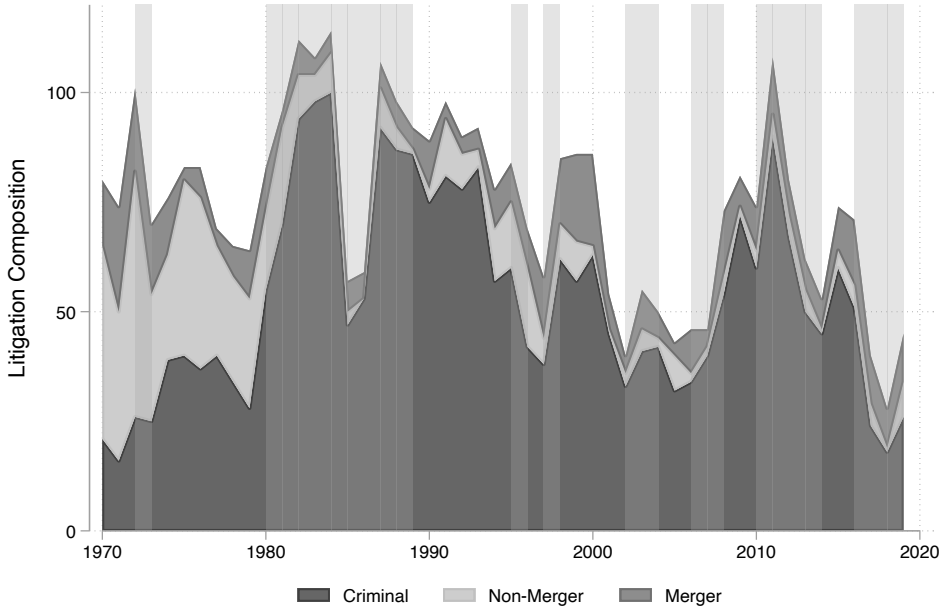

Figure B.2: Antitrust Litigation Portfolios from 1970 to 2019 in Absolute Terms

	N	Mean	S.D.	Min	Max
Criminal Litigation (%)	49	71.1	18.3	21.7	93.3
Merger Litigation (%)	49	13.4	7.4	3.7	32.4
Non-merger Civil Litigation (%)	49	15.5	15.8	0.2	55.4
Budget Reduction	49	0.45	0.50	0	1
Criminal Investigation (%)	49	15.2	6.6	4.9	29.2
Merger Investigation (%)	49	47.3	15.6	15.6	77.2
Professional Composition	49	0.13	0.02	0.10	0.16
Presidential Partisanship	49	0.41	0.50	0	1
Political Appointment	49	0.45	0.50	0	1
Inflation	49	4.04	2.91	-0.32	13.5
Unemployment Rate	49	6.25	1.55	3.89	9.72

Table B.1: Summary Statistics for the Main Regression Results

B.2 Main Regression Table

	(1) Merger/ Criminal	(2) Non-Merger/ Criminal	(3) Non-Merger/ Merger
y_{t-1}	0.499***	0.244*	0.216
	(0.128)	(0.117)	(0.132)
Budget reduction$_t$	-0.220	-0.562*	-0.339
	(0.179)	(0.274)	(0.308)
Presidential partisanship$_t$	-0.167	-0.208	0.051
	(0.192)	(0.288)	(0.331)
Appointment$_t$	-0.046	-0.203	-0.137
	(0.156)	(0.239)	(0.270)
Δ Inflation rate$_t$	0.063	0.062	-0.030
	(0.048)	(0.071)	(0.080)
Δ Unemployment rate$_t$	-0.146	-0.093	-0.002
	(0.089)	(0.131)	(0.149)
Δ Professional composition$_t$	-4.040	-7.016	-2.427
	(8.727)	(13.431)	(15.077)
Criminal investigation$_{t-1}$	-3.252	-9.283***	-4.053
	(1.710)	(2.389)	(2.380)
Merger investigation$_{t-1}$	-0.103	-3.744**	-3.618*
	(0.813)	(1.302)	(1.451)
Trend	0.010	0.011	-0.004
	(0.010)	(0.015)	(0.017)
Constant	-0.604	1.559**	2.401***
	(0.380)	(0.588)	(0.677)
R^2	0.555	0.659	0.477
N	48	48	48

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.2: Regression Results from the Main Model

B.3 Slice the Pie Differently

	(1) Merger/ Criminal	(2) Non-Merger/ Criminal	(3) Others/ Criminal	(4) Non-Merger/ Merger	(5) Others/ Merger	(6) Others/ Non-Merger
y_{t-1}	0.521***	0.263*	0.501***	0.210	0.583***	0.539***
	(0.108)	(0.108)	(0.102)	(0.130)	(0.118)	(0.096)
Budget reduction$_t$	-0.321	-0.664*	-0.602*	-0.339	-0.258	0.052
	(0.186)	(0.270)	(0.267)	(0.308)	(0.277)	(0.379)
Presidential partisanship$_t$	-0.288	-0.368	-0.954***	0.054	-0.646*	-0.530
	(0.200)	(0.284)	(0.284)	(0.331)	(0.289)	(0.402)
Appointment$_t$	0.017	-0.150	0.224	-0.136	0.199	0.397
	(0.163)	(0.236)	(0.232)	(0.270)	(0.240)	(0.330)
Δ Inflation rate$_t$	0.067	0.072	-0.049	-0.030	-0.128	-0.121
	(0.050)	(0.070)	(0.073)	(0.080)	(0.072)	(0.100)
Δ Unemployment rate$_t$	-0.153	-0.079	-0.193	-0.003	-0.041	-0.094
	(0.094)	(0.130)	(0.129)	(0.149)	(0.132)	(0.181)
Δ Professional composition$_t$	-1.444	-6.744	0.788	-2.495	4.784	2.590
	(9.194)	(13.400)	(13.590)	(15.075)	(13.785)	(18.502)
Criminal investigation$_{t-1}$	-3.689*	-10.109***	-4.373*	-4.065	-0.838	2.841
	(1.761)	(2.402)	(2.112)	(2.379)	(2.170)	(2.963)
Merger investigation$_{t-1}$	-0.531	-4.280***	-1.839	-3.637*	-1.267	1.387
	(0.853)	(1.298)	(1.212)	(1.449)	(1.247)	(1.735)
Trend	0.019	0.022	0.046**	-0.004	0.025	0.019
	(0.010)	(0.015)	(0.015)	(0.017)	(0.015)	(0.021)
Constant	-0.180	2.165***	0.073	2.413***	0.320	-1.486
	(0.379)	(0.593)	(0.544)	(0.675)	(0.567)	(0.814)
R^2	0.601	0.688	0.563	0.479	0.433	0.546
N	48	48	48	48	48	48

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.3: Regression Results for the Different Categorization

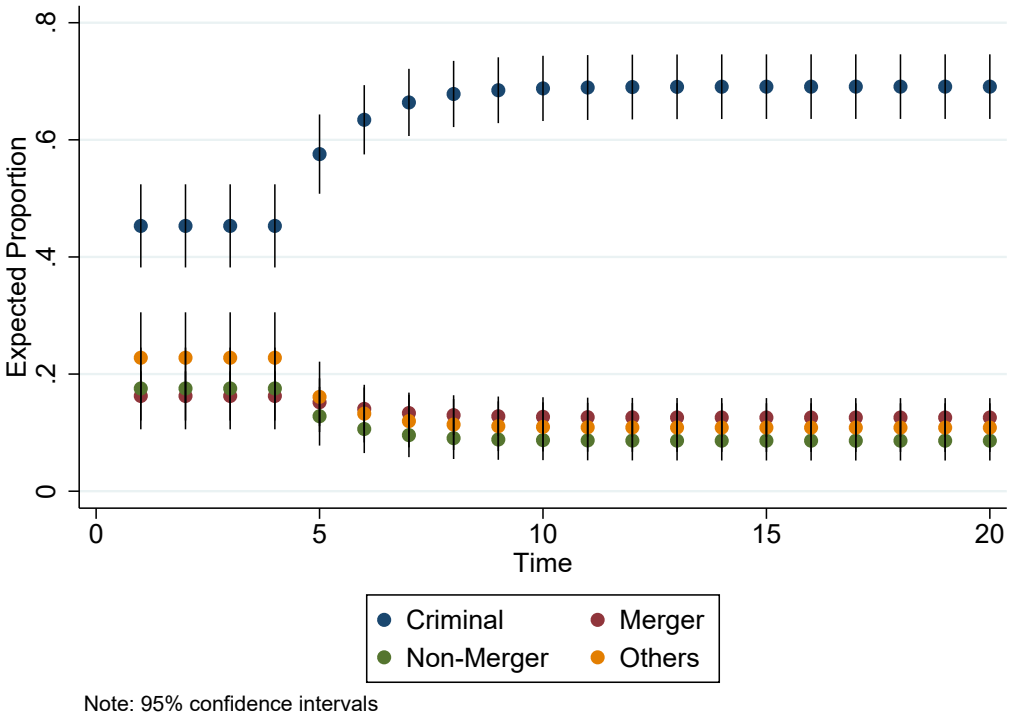

Figure B.3: Cumulative Plot of Simulation Results for the Different Categorization

B.4 Modeling Count Outcomes

	(1) Criminal	(2) Merger	(3) Non-Merger
y_{t-1}	0.661***	0.241	0.406**
	(0.108)	(0.124)	(0.132)
Budget reduction$_t$	8.938	-0.436	-4.311*
	(4.711)	(1.173)	(2.066)
Presidential partisanship$_t$	9.449	0.207	-0.525
	(5.018)	(1.227)	(2.144)
Appointment$_t$	-3.586	-0.332	0.474
	(4.192)	(1.054)	(1.832)
Δ Inflation rate$_t$	-0.414	0.388	-0.397
	(1.250)	(0.306)	(0.535)
Δ Unemployment rate$_t$	4.400	-0.371	-0.666
	(2.281)	(0.580)	(1.005)
Δ Professional composition$_t$	174.624	14.157	39.247
	(232.021)	(57.081)	(104.224)
Criminal investigation$_{t-1}$	0.325	-0.125*	-0.229*
	(0.220)	(0.052)	(0.110)
Merger investigation$_{t-1}$	0.001	0.028**	-0.028
	(0.035)	(0.010)	(0.015)
Trend	-0.060	-0.050	-0.461**
	(0.193)	(0.047)	(0.155)
Constant	1.986	9.573**	30.878***
	(12.381)	(3.426)	(9.313)
R^2	0.631	0.534	0.762
N	48	48	48

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.4: Regression Results using Count Outcomes

C Solutions for the Formal Model

C.1 The Baseline

Proof of Lemma 1:

Proof. Suppose that the agency receives a budget of w and seeks to maximize its utility only in this period. Then, the agency solves the following optimization problem:

$$\max_{r\in[0,1]} \alpha \ln \rho_E r w + (1-\alpha)\ln \rho_D (1-r) w.$$

The first-order condition is:

$$\alpha \frac{1}{r} - (1-\alpha)\frac{1}{1-r} = 0.$$

Multiplying and re-arranging,

$$\alpha(1-r) - (1-\alpha)r = 0.$$

$$\alpha - \alpha r = r - \alpha r.$$

Therefore,

$$r^\dagger = \alpha.$$

This solution is unique and satisfies the condition for a maximum since the second-order condition is:

$$\frac{\partial^2 U_A}{\partial r^2} = -\alpha \frac{1}{r^2} - (1-\alpha)\frac{1}{(1-r)^2} < 0.$$

Under this choice, the agency's performance is defined by $y^\dagger(w) \equiv \rho_D w + \alpha w(\rho_E - \rho_D)$. □

C.2 The Complete Information Game

Proof. Now, I investigate the Subgame Perfect Nash Equilibrium under the assumption of complete information about the politician's performance expectation, implying that τ is public information. For simplicity, I assume that there are only two periods, $t \in \{1, 2\}$. I

restrict attention to the case where $\tau > y^{\dagger}(w = 1)$, since otherwise, the politician obtains her ideal performance while the agency maximizes its utility.

First, I define the budget allocation in which the agency's performance meets the politician's expectation by r':

$$\tau = \rho_E r' w + \rho_D (1 - r') w.$$

Re-arranging:

$$(\rho_E - \rho_D) r' w = \tau - \rho_D w.$$

Therefore,

$$r'(w) \equiv \frac{\tau - \rho_D w}{\rho_E w - \rho_D w},$$

where $r' \in [0, 1]$, as $\max(w) = 1$ and $\tau \in [\rho_D, \rho_E]$. Note that r' is a function of the size of the agency's budget in contrast with $r^{\dagger}$.

Using backward induction, let's turn to the actors' decisions at the final round. At time 2, the agency chooses $r_2 = r^{\dagger} = \alpha$ because the agency will no longer interact with the politician after this round (Lemma 1). In contrast, the politician uses a decision rule of w_2 to influence the agency's budget allocation at time 1, r_1. The politician seeks to pressure the agency to meet her performance expectation at time 1, instead of choosing the budget allocation of α. Given that, the politician sets the decision rule as:

$$U_A(r'|w_1) + \delta U_A(\alpha|w_2 = \beta) \geq U_A(\alpha|w_1) + \delta U_A(\alpha|w_2 = \gamma),$$

where the rate of depreciation is denoted by δ, and β and γ are the amount of the budget that the politician will appropriate when the agency meets and does not meet the performance expectation, respectively. It gives,

$$\ln w_1 + \ln \rho_D (1 - r') + \alpha(\ln \rho_E r' - \ln \rho_D (1 - r')) + \delta[\ln \beta + \ln \rho_D (1 - \alpha) + \alpha(\ln \rho_E \alpha - \ln \rho_D (1 - \alpha))] \geq$$
$$\ln w_1 + \ln \rho_D (1 - \alpha) + \alpha(\ln \rho_E \alpha - \ln \rho_D (1 - \alpha)) + \delta[\ln \gamma + \ln \rho_D (1 - \alpha) + \alpha(\ln \rho_E \alpha - \ln \rho_D (1 - \alpha))].$$

Re-arranging:

$$\delta \ln \frac{\beta}{\gamma} \geq \alpha \ln \frac{\alpha}{r'} + (1-\alpha) \ln \frac{1-\alpha}{1-r'}$$

Define $S \equiv \frac{1}{\delta}[\alpha \ln \frac{\alpha}{r'} + (1-\alpha) \ln \frac{1-\alpha}{1-r'}]$,

$$\frac{\beta}{\gamma} \geq e^S.$$

Therefore

$$\beta^* \geq e^S \gamma^*,$$

and $S > 0$ because:

$$\frac{1}{\delta}[\alpha \ln \frac{\alpha}{r'} + (1-\alpha) \ln \frac{1-\alpha}{1-r'}] > 0.$$

$$\ln \frac{1-\alpha}{1-r'} + \alpha \ln \frac{(1-\alpha)r'}{(1-r')\alpha} > 0.$$

Given that y is increasing in r and the restriction of $\tau > y^\dagger(w=1)$, r' is always greater than α in all budget constraints. Thus, the first term of $\ln \frac{1-\alpha}{1-r'}$ is positive since $1-\alpha > 1-r'$. In addition, the second term is also positive as,

$$\frac{(1-\alpha)r'}{(1-r')\alpha} > 1,$$

which gives,

$$(1-\alpha)r' > (1-r')\alpha.$$

$$r' > \alpha$$

Therefore, β^* is greater than γ^*, as $S > 0$ and $e^S > 1$. For an interior solution, I restrict $\beta^* \in (0, 1]$ and $\gamma^* \in (0, \frac{1}{e^S}]$. Under this politician's decision rule, the agency will be indifferent between choosing $r_1 = r'(w_1)$ or $r_1 = \alpha$.

Given the A's strategy, the minimum budget size that met the performance threshold

in the first period is $\underline{w}_1 = \frac{\tau}{\rho_D}$. Therefore,

$$\text{SPNE} = \left\{ w_1^* \in \left[\frac{\tau}{\rho_D}, 1\right],\ r_1^* = r'(w_1^*),\ w_2^* = \begin{cases} \beta^* \in [e^S\gamma^*, 1], \text{ if } y_1^* \geq \tau, \\ \gamma^* \in \left(0, \frac{1}{e^S}\right], \text{ otherwise} \end{cases},\ r_2^* = \alpha. \right\}$$

and

$$\text{On-the-path} = \left(w_1^* = 1,\ r_1^* = \frac{\tau - \rho_D}{\rho_E - \rho_D},\ w_2^* = 1,\ r_2^* = \alpha \right)$$

□

Two things are noteworthy: first, γ^* is always lower than β^*. This implies that the politician uses a threat of budget reductions to make the agency accomplish the threshold when citizens' policy preferences are publicly revealed. Second, the agency's budgets have never been deducted. The invisibility of budget reductions shows that the threat was effective.

C.3 The Incomplete Information Game

C.3.1 Information and Beliefs

Let $\underline{\tau}_t^j$ and $\overline{\tau}_t^j$ are the actor j's posterior beliefs of the lower and upper bound of τ depending on the history up to time t, respectively. For example, at the beginning of the game, both the politician and the agency hold only the prior belief of the distribution of τ as $\underline{\tau}_1^P = \underline{\tau}_1^A = \rho_D$ and $\overline{\tau}_1^P = \overline{\tau}_1^A = \rho_A$. Yet, the learning process is not identical between these two actors. For the politician,

$$\tau_t^P \sim \begin{cases} U\left(\max(\underline{\tau}_{t-1}^P, y_{t-1}),\ \overline{\tau}_{t-1}^P\right) & \text{if } U_{t-1}^P = -1, \\ U\left(\underline{\tau}_{t-1}^P,\ \min(\overline{\tau}_{t-1}^P, y_{t-1})\right] & \text{if } U_{t-1}^P = 0. \end{cases}$$

For the agency,

$$\tau_t^A \sim \begin{cases} \tau_{t-1}^A & \text{if } w_t^*(y_{t-1} \geq \tau) = w_t^*(y_{t-1} < \tau), \\ U\left(\max(\underline{\tau}_{t-1}^P, y_{t-1}),\ \overline{\tau}_{t-1}^P\right) & \text{if } w_t = w_t^*(y_{t-1} < \tau) \neq w_t^*(y_{t-1} \geq \tau), \\ U\left(\underline{\tau}_{t-1}^P,\ \min(\overline{\tau}_{t-1}^P, y_{t-1})\right] & \text{if } w_t = w_t^*(y_{t-1} \geq \tau) \neq w_t^*(y_{t-1} < \tau). \end{cases}$$

The politician updates the posterior beliefs by observing her utility. If she had a negative utility in the previous term, she can become aware that the agency should perform better than its previous performance to achieve the threshold. In contrast, if she did not have a negative utility, she notices that the previous performance is over the threshold. In addition, the (un)successful performance at the previous term, $y_{t-1} \geq \tau$ ($y_{t-1} < \tau$), does not give any information about the upper (lower) bound of the performance threshold, so the politician maintains the posterior belief of $\overline{\tau}_{t-1}^P$ ($\underline{\tau}_{t-1}^P$) at time t.

On the other hand, the agency can update the posterior beliefs only when the politician holds different strategies of budget appropriations depending on whether it succeeded to achieve the threshold at the previous term. If this is not the case, the agency needs to maintain the previous posterior belief of τ at this term. Only when the time t politician's strategy depends on the agency's performance at time $t-1$, the agency can update the posterior beliefs by observing the budget appropriation at time t.

C.3.2 Perfect Bayesian Equilibrium

Proof. From here, I make a small change in the agency's performance function as:

$$y_i = \rho_i(r_i + e)w,$$

where e is a positive number close to zero. The reason is that the addition of e allows to define the agency's utility function under $r = 1$ and 0. Substantively, one can interpret e as bureaucratic efforts boosted in the size of the total agency's budget. So now, the

agency's utility function is:

$$\begin{aligned} U_A(r, w) &= \alpha \ln \rho_E(r + e)w + (1 - \alpha) \ln \rho_D(1 - r + e)w \\ &= \ln \rho_D(1 - r + e)w + \alpha \ln \frac{\rho_E(r + e)}{\rho_D(1 - r + e)}. \end{aligned}$$

The addition of e allows us to define the agency's utility under $r = 1$ and $r = 0$. Based on the new functions, $r^\dagger$ and $y^\dagger(w)$ are, respectively:

$$r^\dagger = \alpha(1 + 2e) - e,$$

and

$$\begin{aligned} y^\dagger(w) &= w \left[\rho_D + r^\dagger(\rho_E - \rho_D) + e(\rho_E + \rho_D)\right] \\ &= w \left[\rho_D + (\alpha(1 + 2e) - e)(\rho_E - \rho_D) + e(\rho_E + \rho_D)\right] \\ &= w(1 + 2e) \left[\alpha(\rho_E - \rho_D) + \rho_D\right]. \end{aligned}$$

These solutions converge to the originals when $e = 0$.

Let's use backward induction to solve the equilibrium. For simplicity, I suppose there is no discount factor. At the last term, the agency chooses $r_3^* = r^\dagger = \alpha(1 + 2e) - e$ regardless of the history up to time 3 (Lemma 1).

At time 3, the politician's optimization problem is:

$$w_3^* = \max_{w_3} \mathbb{E}_P[-\mathbb{1}(y_3(w_3) < \tau)|r_3^*, \tau_2^P].$$

The expected utility of the politician is:

$$\mathbb{E}_P\left[-\mathbb{1}(y_3 < \tau)|r_3^*, \tau_2^P\right] = -\Pr(y_3 < \tau|r_3^*, \tau_2^P) = \begin{cases} -1 & \text{if } y^\dagger(w_3) < \underline{\tau}_2^P, \\ -\frac{\overline{\tau}_2^P - y^\dagger(w_3)}{\overline{\tau}_2^P - \underline{\tau}_2^P} & \text{if } \underline{\tau}_2^P \le y^\dagger(w_3) \le \overline{\tau}_2^P, \\ 0 & \text{if } \overline{\tau}_2^P < y^\dagger(w_3), \end{cases}$$

where $y^{\dagger}(w_3)$ represents the agency's performance under w_3. It shows that the politician will experience the utility of -1 (0) with certainty if the agency performs lower (higher) than her posterior beliefs of the lower (upper) bound of the performance threshold. Otherwise, her expected utility will increase in w_3. Given that, we can represent a set of budget appropriations (w_3') to which the politician becomes indifferent as:

$$w_3' = \begin{cases} (0,1] & \text{if } y^{\dagger}(1) < \underline{\tau}_2^P, \\ 1 & \text{if } \underline{\tau}_2^P \leq y^{\dagger}(1) \leq \overline{\tau}_2^P, \\ [\underline{w}^{\dagger}(\overline{\tau}_2^P), 1] & \text{if } \overline{\tau}_2^P < y^{\dagger}(1), \end{cases}$$

where $\underline{w}^{\dagger}(\cdot)$ indicates the size of the budget which produces a bureaucratic performance under $r = r^{\dagger} = \alpha(1+2e) - e$.

In Table C.5, I present each potential case of the game's history, the corresponding posterior beliefs, and the set of budget appropriations that identically maximizes the utility in each case. The table is divided into three sections based on the time frame. The sections for times 1 and 2 contain columns for agency performance, whether or not the threshold was achieved, and the updated posterior beliefs. F and S denote whether $y_t < \tau$ or not, respectively. The section for time 3 exclusively includes the column for w_3', which depends on the history of each specific case.

This indifferent set of time 3 budgets (w_3') provides the politician with the potential for a credible threat. She can employ the decision rules of time 3 budgets from w_3' to influence the agency's choice of time 2 budget allocation (r_2^*). For instance, she can threaten a substantial budget cut at time 3 if the agency fails to meet the performance threshold at time 2. This threat would be credible as long as the budget reduction falls within her indifferent set of time 3 budgets, given the history of each specific case.

Now, let's examine each case to see how her posterior beliefs change in the second period, and consequently, how she anticipates her utility. On one hand, consider cases where the agency failed to meet the threshold in the first period, $y_1 < \tau$ (cases 1, 3, and 5). In these instances, the politician's posterior is $\tau_1^P \sim U(y_1, \rho_E)$. And, her time 2

	$t=1$			$t=2$			$t=3$
Case	y_1	S/F	τ_1^P	y_2	S/F	τ_2^P	w_3'
1.1	$y^\dagger(1) > y_1$	F	$U(y_1, \rho_E)$	$y_2 \geq y^\dagger(1) > y_1$	F	$U(y_2, \rho_E)$	(0,1]
1.2					S	$U(y_1, y_2]$	1
1.3				$y^\dagger(1) > y_2 > y_1$	F	$U(y_2, \rho_E)$	1
1.4					S	$U(y_1, y_2]$	$[\underline{w}^\dagger(y_2),\ 1]$
1.5				$y^\dagger(1) > y_1 \geq y_2$	F	$U(y_1, \rho_E)$	1
2.1		S	$U(\rho_D, y_1]$	$y_2 \geq y^\dagger(1) > y_1$	S	$U(\rho_D, y_1]$	$[\underline{w}^\dagger(y_1),\ 1]$
2.2				$y^\dagger(1) > y_2 \geq y_1$	S	$U(\rho_D, y_1]$	$[\underline{w}^\dagger(y_1),\ 1]$
2.3				$y^\dagger(1) > y_1 > y_2$	F	$U(y_2, y_1]$	$[\underline{w}^\dagger(y_1),\ 1]$
2.4					S	$U(\rho_D, y_2]$	$[\underline{w}^\dagger(y_2),\ 1]$
3.1	$y_1 = y^\dagger(1)$	F	$U(y_1, \rho_E)$	$y_2 > y_1 = y^\dagger(1)$	F	$U(y_2, \rho_E)$	(0,1]
3.2					S	$U(y_1, y_2]$	(0,1]
3.3				$y_1 = y^\dagger(1) \geq y_2$	F	$U(y_1, \rho_E)$	(0,1]
4.1		S	$U(\rho_D, y_1]$	$y_2 \geq y_1 = y^\dagger(1)$	S	$U(\rho_D, y_1]$	1
4.2				$y_1 = y^\dagger(1) > y_2$	F	$U(y_2, y_1]$	1
4.3					S	$U(\rho_D, y_2]$	$[\underline{w}^\dagger(y_2),\ 1]$
5.1	$y_1 > y^\dagger(1)$	F	$U(y_1, \rho_E)$	$y_2 > y_1 > y^\dagger(1)$	F	$U(y_2, \rho_E)$	(0,1]
5.2					S	$U(y_1, y_2]$	(0,1]
5.3				$y_1 \geq y_2 > y^\dagger(1)$	F	$U(y_1, \rho_E)$	(0,1]
5.4				$y_1 > y^\dagger(1) \geq y_2$	F	$U(y_1, \rho_E)$	(0,1]
6.1		S	$U(\rho_D, y_1]$	$y_2 \geq y_1 > y^\dagger(1)$	S	$U(\rho_D, y_1]$	1
6.2				$y_1 > y_2 > y^\dagger(1)$	F	$U(y_2, y_1]$	(0,1]
6.3					S	$U(\rho_D, y_2]$	1
6.4				$y_1 > y^\dagger(1) \geq y_2$	F	$U(y_2, y_1]$	1
6.5					S	$U(\rho_D, y_2]$	$[\underline{w}^\dagger(y_2),\ 1]$

Table C.5: The History of the Game, Politician's Posterior Beliefs, and Budget Appropriations

expected utility is:

$$\mathbb{E}_P\left[-\mathbb{1}(y_2 < \tau)|y_2, U(y_1, \rho_E)\right] = -\Pr(y_2 < \tau|y_2, \tau_1^P) = \begin{cases} -1 & \text{if } y_1 \geq y_2, \\ -\frac{\rho_E - y_2}{\rho_E - y_1} & \text{if } y_1 < y_2. \end{cases}$$

It indicates that (1) the politician strongly favors the agency to perform better than how it did at time 1, and (2) her expected utility rises with y_2, when $y_2 > y_1$.

On the other hand, if the agency succeeded in meeting the threshold in the first period, $y_1 \geq \tau$ (cases 2, 4, and 6), the politician's posterior becomes $\tau_1^P \sim U(\rho_D, y_1]$. Therefore, her expected utility at time 2 is:

$$\mathbb{E}_P\left[-\mathbb{1}(y_2 < \tau)|y_2, U(\rho_D, y_1]\right] = -\Pr(y_2 < \tau|y_2, \tau_1^P) = \begin{cases} -\frac{y_1 - y_2}{y_1 - \rho_D} & \text{if } y_1 > y_2, \\ 0 & \text{if } y_1 \leq y_2. \end{cases}$$

In these cases, (1) the politician's expected utility increases in y_2 up until $y_2 = y_1$, and (2) she is indifferent to the agency's performance when it is equal to or exceeds y_1.

Accordingly, P's decision rules for w_3 purpose to maximize y_2 in cases 1, 3, and 5, and to achieve y_2 at the level of y_1 in cases 2, 4, and 6. For a threat to be both effective and credible, it must fulfill the following conditions: first, the politician should propose a higher or at least the same budget for superior performances or successful instances in the second period (*effectiveness*). Second, the proposed budgets should lie within the indifferent set of time 3 budgets (w_3'), contingent upon the history of each specific case (*credibility*). Given these conditions, let's investigate P's optimal choice for time 3 budgets.

Case 1: The case history reveals that the agency under-performed during the first period, falling below $y^\dagger(1)$, and failed to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(y_1, \rho_E)$. With her expected utility increasing in time 2 agency performance, the politician aims to maximize budget allocation to task E using the decision rules for time 3 budgets.

However, in this scenario, the politician cannot make a threat that is both credible and effective. First, if the agency chooses to perform below $y^{\dagger}(1)$, any threats of budget cuts will lack credibility since a failure in the second period (cases 1.3 and 1.5) would necessitate a maximum third-period budget of 1 to maximize P's expected utility for that period. Second, to maximize second-period performance, there is no leeway for budget cuts in the final period. In case 1.4, P must provide a third-period budget of 1 since the agency would receive a budget of 1 if it failed to meet the threshold (cases 1.3 and 1.5). In essence, the politician must guarantee a third-period budget of 1 to prevent the agency from reducing its second-period performance to maximize its expected utility at time 3. It necessitates that the politician provides a third-period budget of 1 even in case 1.1. If this does not occur, the agency will be incentivized to under-perform in the second period, performing below $y^{\dagger}(1)$, to avoid a potential budget cut in case 1.1. Therefore,

$$w_3^*|_{\text{case 1}} = 1.$$

Then, the agency's optimization problem at time 2 is:

$$r_2^*|_{\text{case 1}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r_3^*, w_3^*),$$

where $r_3^* = r^{\dagger}$, and $w_3^* = 1$. By Lemma 1, it gives

$$r_2^*|_{\text{case 1}} = r^{\dagger}$$

But, under this strategy, the agency would fail to achieve the performance threshold regardless of the size of the second-period budget. Thus, the politician is indifferent with any size of the second-period budget:

$$(w_2', r_2^*)|_{\text{case 1}} = \big((0, 1], r^{\dagger}\big)$$

Case 2: The case history reveals that the agency under-performed during the first period, falling below $y^{\dagger}(1)$, and succeeded to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(\rho_D, y_1]$. In this information set, the politician aims to achieve y_2 to at least the level of y_1 using the decision rules for time 3 budgets.

In this scenario, the politician has the opportunity to make a credible threat, since a second-period agency performance lower than that of the first-period leaves room for third-period budgets (w_3'), which leaves her indifferent. To encourage the agency to perform at the level of the first period, the politician can give a maximum third-period budget of 1 only if $y_2 \geq y_1$ (cases 2.1 and 2.2). However, if the agency's performance in the second period falls below its first-period performance ($y_2 < y_1$), the politician may offer $\underline{w}^{\dagger}(y_1)$, which is the minimum third-period budget from the set of indifferent third-period budgets satisfying the condition of effectiveness (cases 2.3 and 2.4).

Under these P's decision rules, the agency must decide whether to perform over or equal to the first period and receive the maximum budget or to perform less than the first period and take a budget cut. If the agency chooses the first option (cases 2.1 and 2.2), its optimization problem becomes:

$$r_2^*|_{\text{cases 2.1 and 2.2}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r^{\dagger}, 1)$$

which gives $r_2^{\text{int}} = r^{\dagger}$ (Lemma 1). But, because of the performance constraint, the solution is interior only until the second-period budget can match the first-period performance with the budget allocation of $r_2^{\dagger}$, $w_2 \geq \underline{w}^{\dagger}(y_1) = \frac{y_1}{(1+2e)[\alpha(\rho_E - \rho_D) + \rho_D]}$. If it is not the case, the agency has a corner solution in which it performs as much as y_1 under a given budget:

$$y_1 = w_2 \left[\rho_D + r_2(\rho_E - \rho_D) + e(\rho_E + \rho_D)\right]$$

Re-arranging,

$$r_2^{\text{con}} = \frac{y_1}{w_2(\rho_E - \rho_D)} - \frac{\rho_D + e(\rho_E + \rho_D)}{\rho_E - \rho_D}$$

Therefore,

$$r_2^*|_{\text{cases 2.1 and 2.2}} = \begin{cases} r^\dagger & \text{if } w_2 \geq \underline{w}^\dagger(y_1) \\ \frac{y_1}{w_2(\rho_E - \rho_D)} - \frac{\rho_D + e(\rho_E + \rho_D)}{\rho_E - \rho_D} & \text{otherwise.} \end{cases}$$

On the other hand, the agency's optimization problem is for cases 2.3 and 2.4:

$$r_2^*|_{\text{cases 2.3 and 2.4}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r^\dagger, \underline{w}^\dagger(y_1))$$

This also gives $r_2^{\text{int}} = r^\dagger$ (Lemma 1). But, due to the performance constraint, this solution remains interior only until the second-period budget cannot ensure a performance equal to the first period's, given the budget allocation of $r_2^\dagger$, so $w_2 < \underline{w}^\dagger(y_1)$. If this condition does not hold, the agency would rather stick with the budget allocation of $r^\dagger$. This strategy maximizes its second-period utility within a given budget while also securing the maximum budget for the final period, even if it leads to breaching the performance constraint.

Now, we need to compare A's utility between the choices of $r^2 = \frac{y_1}{w_2(\rho_E - \rho_D)} - \frac{\rho_D + e(\rho_E + \rho_D)}{\rho_E - \rho_D}$ and $r^2 = r^\dagger$ given the budget constriant of $w_2 < \underline{w}^\dagger(y_1)$. This will help to define A's strategy in case 2. Nevertheless, it would be off-the-path because the politician surely offers the second-period budget exceeding $\underline{w}^\dagger(y_1)$ to avoid a potential utility discount in the final period. Therefore,

$$(w_2', r_2^*)|_{\text{case 2}} = \left([\underline{w}^\dagger(y_1), 1], r^\dagger\right)$$

Case 3: The case history reveals that the agency performed as much as $y^\dagger(1)$ during the first period, and failed to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(y_1, \rho_E)$. With her expected utility increasing in time 2 agency performance, the politician aims to maximize budget allocation to task E using the decision rules for time 3 budgets.

Contrary to case 1, the politician has the opportunity to make a credible threat, since

an agency's failure in the second-period leaves room for third-period budgets (w_3'), which leaves her indifferent. To maximize the second-period performance, the politician can give a maximum third-period budget of 1 only if it succeeds to achieve the threshold (case 3.2). Otherwise, the politician can offer the smallest budget of $\varepsilon > 0$ in the third period (cases 3.1 and 3.3).

Under these P's decision rules, the agency must decide whether to perform over the first period and receive the maximum budget ($y_2 > y_1$) or to perform less than or equal to the first period and take a substantial budget cut ($y_2 \leq y_1$). If the agency chooses the first option (cases 3.1 and 3.2), its optimization problem becomes:

$$\begin{aligned} r_2^*|_{\text{cases 3.1 and 3.2}} &= \max_{r_2} U_2^A(r_2, w_2) + \mathbb{E}[U_3^A(r^\dagger, w_3^*)] \\ &= \max_{r_2} U_2^A(r_2, w_2) + \Pr(y_2 \geq \tau) \cdot U_3^A(r^\dagger, 1) + (1 - \Pr(y_2 \geq \tau)) \cdot U_3^A(r^\dagger, \varepsilon) \end{aligned}$$

The agency's expected utility gives:

$$\ln w_2 \varepsilon (1 - r_2 + e)(1 - \alpha)(1 + 2e)\rho_D^2 + \alpha \ln \frac{r_2 + e}{1 - r_2 + e} \frac{\alpha}{1 - \alpha} \frac{\rho_E^2}{\rho_D^2} - \Pr(y_2 \geq \tau) \cdot \ln \varepsilon$$

Given the history for this specific case, $\Pr(y_2 \geq \tau) = \frac{y_2 - y_1}{\rho_E - y_1}$ and $y_2 = w_2[\rho_D + r_2(\rho_E - \rho_D) + e(\rho_E + \rho_D)]$. When ε converges to zero, the expected utility increases in r_2. Thus, it has a corner solution of $r_2^*|_{\text{cases 3.1 and 3.2}} = 1$. This implies that the agency would produce the best performance within a given budget to minimize the potential for a substantial budget cut in the final period.

On the other hand, for case 3.3 the agency's optimization problem is:

$$r_2^*|_{\text{case 3.3}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r^\dagger, \varepsilon)$$

which gives $r_2^* = r^\dagger$ (Lemma 1). This interior solution meets the performance constraint since the maximum level of the second-period performance within the strategy is $y^\dagger(1)$, which is equal to y_1.

Under this A's strategy, the politician would offer the second-period budget that

allows the agency to perform equal to or more than the threshold unconditionally:

$$\overline{\tau}_1^P = \rho_E \leq y_2(r_2 = 1) = \rho_E(1+e)w_2$$

Thus,

$$w_2 \geq \frac{1}{1+e}$$

Therefore,

$$(w_2', r_2^*)|_{\text{case 3}} = ([1-\epsilon, 1], 1)\,,$$

where $\epsilon \equiv \frac{e}{1+e}$.

Case 4: The case history reveals that the agency performed as much as $y^\dagger(1)$, and succeeded to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(\rho_D, y_1]$. In this information set, the politician aims to achieve y_2 to at least the level of y_1 using the decision rules for time 3 budgets.

In this case, the politician cannot make a credible threat that satisfies the condition of effectiveness, because she must offer the maximum third-period budget of 1 even if the agency chooses to perform below the first-period performance and fail to meet the threshold at time 2. Thus, the politician would offer the maximum budget of 1 in the final period, regardless of the second-period performance. Then, the agency's optimization problem at time 2 is:

$$r_2^*|_{\text{case 4}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r_3^*, 1),$$

where $r_3^* = r^\dagger$, and $w_3^* = 1$. By Lemma 1, it gives$r_2^*|_{\text{case 4}} = r^\dagger$. Given that, the politician must provide a maximum budget of 1 to avoid a potential utility discount in the second period. Therefore,

$$(w_2', r_2^*)|_{\text{case 4}} = (1, r^\dagger)$$

Case 5: The case history reveals that the agency performed over $y^\dagger(1)$ during the first period, and failed to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(y_1, \rho_E)$. With her expected utility increasing in time 2 agency performance, the politician aims to maximize budget allocation to task E using the decision rules for time 3 budgets.

We can apply the same logic with case 3 in this case. To maximize the second-period performance, the politician can give a maximum third-period budget of 1 only if it succeeds to achieve the threshold (case 5.2). Otherwise, the politician can offer the smallest budget of $\varepsilon > 0$ in the third period (cases 5.1, 5.3, and 5.4).

Under these P's decision rules, the agency must decide whether to perform over the first period and receive the maximum budget ($y_2 > y_1$) or to perform less than or equal to the first period and take a substantial budget cut ($y_2 \leq y_1$). If the agency chooses the first option (cases 5.1 and 5.2), its optimization problem becomes:

$$\begin{aligned} r_2^*|_{\text{cases 5.1 and 5.2}} &= \max_{r_2} U_2^A(r_2, w_2) + \mathbb{E}[U_3^A(r^\dagger, w_3^*)] \\ &= \max_{r_2} U_2^A(r_2, w_2) + \Pr(y_2 \geq \tau) \cdot U_3^A(r^\dagger, 1) + (1 - \Pr(y_2 \geq \tau)) \cdot U_3^A(r^\dagger, \varepsilon) \end{aligned}$$

This leads to a corner solution of $r_2^*|_{\text{cases 5.1 and 5.2}} = 1$. On the other hand, for case 5.3 and 5.4 the agency's optimization problem is:

$$r_2^*|_{\text{cases 5.3 and 5.4}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r^\dagger, \varepsilon)$$

which gives $r_2^* = r^\dagger$ (Lemma 1). This interior solution meets the performance constraint since the maximum level of the second-period performance within the strategy ($y^\dagger(1)$) is lower than y_1. Applying the same logic with case 2, therefore,

$$(w_2', r_2^*)|_{\text{case 5}} = ([1 - \epsilon, 1], 1)$$

Case 6: The case history reveals that the agency performed over $y^\dagger(1)$, and succeeded

	$t=1$			$t=2$	
Case	y_1	S/F	τ_1^P	r_2^*	w_2'
1	$y^\dagger(1) > y_1$	F	$U(y_1, \rho_E)$	$r^\dagger$	$(0, 1]$
2		S	$U(\rho_D, y_1]$	$r^\dagger$	$[\underline{w}^\dagger(y_1), 1]$
3	$y_1 = y^\dagger(1)$	F	$U(y_1, \rho_E)$	1	$[1-\epsilon, 1]$
4		S	$U(\rho_D, y_1]$	$r^\dagger$	1
5	$y_1 > y^\dagger(1)$	F	$U(y_1, \rho_E)$	1	$[1-\epsilon, 1]$
6		S	$U(\rho_D, y_1]$	$r^\dagger$	1

Table C.6: Optimal Budget Allocations and Indifferent Set at Time 2

to achieve the threshold. As a result, the politician updated her posterior beliefs to $\tau_1^P \sim U(\rho_D, y_1]$. In this information set, the politician aims to achieve y_2 to at least the level of y_1 using the decision rules for time 3 budgets.

However, the politician cannot make a credible threat that satisfies the condition of effectiveness, because she must offer the maximum third-period budget of 1 even if the agency chooses to perform less than or equal to $y^\dagger(1)$ and fail to meet the threshold at time 2. Thus, the politician would offer the maximum budget of 1 in the final period, regardless of the second-period performance. Then, the agency's optimization problem at time 2 is:

$$r_2^*|_{\text{case 6}} = \max_{r_2} U_2^A(r_2, w_2) + U_3^A(r_3^*, 1),$$

where $r_3^* = r^\dagger$, and $w_3^* = 1$. By Lemma 1, it gives $r_2^*|_{\text{case 6}} = r^\dagger$. Given that, the politician must provide a maximum budget of 1 to minimize the potential for a utility discount in the second period. Therefore,

$$(w_2', r_2^*)|_{\text{case 6}} = (1, r^\dagger)$$

Now, let's turn to the politician's optimal choice for the second-period budget. The politician may use the decision rules for w_2 to influence the agency's budget allocation at time 1 (r_1). In the first information set, $\tau \sim U(\rho_D, \rho_E)$, P's expected utility rises with the agency performance.

The politician can make a credible threat that pressures the agency not to perform

less than $y^\dagger(1)$, because she can offer the minimum budgets from the indifferent set (ε and $\underline{w}^\dagger(1)$) if the agency performed under $y^\dagger(1)$.

And, if the agency fails to meet the threshold with the first-period performance of $y_1 \geq y^\dagger(1)$, the politician must offer a second-period budget of $1-\epsilon$ to make the agency be informed of the failure. If this is not the case, the agency cannot distinguish whether it succeeded or failed in the first period by observing the second-period budget. Then, in cases where $y_1 \geq y^\dagger(1)$, the agency's optimization problem is

$$r_1^*|_{\text{cases 3, 4, 5, and 6}} = \max_{r_1} U_1^A(r_1, w_1) + \mathbb{E}[U_2^A(r_2^*, w_2^*)] + U_3^A(r^\dagger, 1),$$

since these cases lead to the maximum final-period budget with certainty. Remaining only relevant factors:

$$r_1^*|_{\text{cases 3, 4, 5, and 6}} = \max_{r_1} U_1^A(r_1, w_1) + \Pr(y_1 \geq \tau)\left[U_2^A(r^\dagger, 1) - U_2^A(1, 1-\epsilon)\right].$$

Let's define the factors inside the bracket as K:

$$\begin{aligned} U_2^A(r^\dagger, 1) - U_2^A(1, 1-\epsilon) &= \ln \rho_D(1-\alpha)(1+2e) + \alpha \ln \frac{\rho_E \alpha}{\rho_D(1-\alpha)} - \ln \rho_D e(1-\epsilon) - \alpha \ln \frac{\rho_E(1+e)}{\rho_D e} \\ &= \ln \frac{(1-\alpha)(1+2e)}{e(1-\varepsilon)} + \alpha \ln \frac{\alpha e}{(1-\alpha)(1+e)} \equiv K \end{aligned}$$

Then, the F.O.C. is:

$$\frac{\alpha}{r_1+e} - \frac{1-\alpha}{1-r_1+e} + \frac{\partial \Pr(y_1 \geq \tau)}{\partial r_1} K = 0.$$

As $\frac{\partial \Pr(y_1 \geq \tau)}{\partial r_1} = 1$,

$$\frac{\alpha}{r_1+e} - \frac{1-\alpha}{1-r_1+e} + K = 0,$$

which gives,

$$-Kr_1^2 + (K-1)r_1 + \alpha + 2\alpha e + eK + e^2 K - e = 0.$$

The positive r value that satisfies this condition is:

$$r_1^* = \frac{K - 1 + \sqrt{(K-1)^2 + 4K(\alpha + 2\alpha e + eK + e^2K - e)}}{2K} \equiv R$$

which is always greater than $r^\dagger$ and converges to 1 as e is closer to 0. Given that, the agency chooses to perform equal to or more than the threshold to avoid a potential substantial budget cut in the second period. And, the politician will offer the maximum budget of 1 in the first period to maximize the chance of the agency to meet the threshold. Therefore, there is a Perfect Bayesian equilibrium, where on-the-path the agency chooses

$$(r_1^*, r_2^*, r_3^*) = \begin{cases} (R, r^\dagger, r^\dagger) & \text{if } \; y_1^* \geq \tau, \\ (R, 1, r^\dagger) & \text{if } \; y_1^* < \tau, \end{cases}$$

and the politician chooses

$$(w_1^*, w_2^*, w_3^*) = \begin{cases} (1, 1, 1) & \text{if } \; y_1^* \geq \tau, \\ (1, 1 - \epsilon, 1) & \text{if } \; y_1^* < \tau. \end{cases}$$

□