Can Bureaucratic Leadership Mitigate Common Agency Problems?

Institutional Policy Conflict and the Political Calculus of Budgetary Support for U.S. Federal Agencies

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March 5, 2015

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Abstract

In the United States, political principals encounter a dual coordination problem, whereby the legislative and executive branches must coordinate with each other as well as with federal agencies to carry out policy initiatives. This paper advances a theory to explain how the presidential loyalty associated with agency leaders influence political support for their agencies. Empirical predictions generated from this theory are tested using presidential and congressional budgetary data from 31 U.S. federal agencies from FY 1978 to FY 2009. Statistical evidence indicates that budgetary support is increasing in the agency leader's loyalty to the president only when an agency's policy mission conflicts with a given political principal during unified party government. Further, "conflictual" agencies' comparatively greater budgetary support under divided party government vis-à-vis unified party government is decreasing in the agency leader's loyalty to the president. Agency leadership cannot effectively resolve vertical conflicts between politicians and agencies when common agency problems transpire between political principals.

"A bill that's signed by the president is an unfinished clay pot. You have the basic structure there, but what it looks like in the end depends on the attitude of congressional funders and how vigorously the agency chooses to implement it."

> Carol Tucker-Foreman (Consumer Federation of America: Food Policy Institute, former Assistant Secretary of Agriculture for Food and Consumer Services [1977−1981]). Source: "GOP May Slow Food-Safety Law Overhaul." *Washington Post* (12/25/2010).

Resources constitute the most important input to all organizations since such organizations need them to function properly, if at all (March 1999; Pfeffer and Salancik 2003; Stinchcombe 1990). Without resources, public agencies have limited capacity to undertake policy and administrative tasks. Government organizations that experience resource constraints become less responsive to external audiences due to hindered information processing capacities, are less capable of innovation due to the lack of slack resources, and engage in destructive forms of competition over scarce resources both within and between firms (March and Simon 1992). Resources, in the form of budgets, also represent allocations of policymaking power by delegating and oversight institutions (Fenno 1966; Wildavsky 1988). In short, budgetary resources signal tangible political support for bureaucratic agencies within the context of a multi-tiered hierarchy (Padgett 1981; Carpenter 1996).

Prior studies analyzing political control of administrative agencies through budgetary mechanisms demonstrate that politicians make resources decisions regarding government agencies with strategic policy considerations in mind. Agency budgets serve as a critical *ex post* control mechanism that politicians employ to influence the behavior of bureaucratic agencies (Carpenter 1996; Moe 1982; Ting 2001; Wood and Waterman 1994; Weingast 1984). Because bureaucrats possess innate information advantages in the utilization of budgetary resources (e.g., Banks and Weingast 1992; Bendor, Taylor, and Van Gaalen 1985; Miler and Moe 1983), it is

critical to understand how politicians manage government agencies – based both on the type of agents that they routinely must entrust with policymaking authority and the organizational context in which these agents operate.

Recent research has made important strides in analyzing the link between agency characteristics and agency resource allocation choices made by politicians. For example, Christopher Berry and Jacob Gersen's (2010) insightful study of grant allocation by distributive agencies finds that less insulated government agencies (i.e., higher mean proportion of appointed political executives) are more responsive to both presidential and congressional funding priorities. While this study makes an important contribution to understanding the policymaking consequences of agency structure, it does not consider the individual-level traits of agency officials who are responsible for directing agency activities.[1] Using ideal point estimates culled from congressional testimony, Anthony Bertelli and Christian Grose (2011) offer a novel and compelling test of theoretical predictions generated from the "Appointments Dilemma" model of McCarty (2004) by uncovering evidence that the congressional discretionary budgetary authority obtained by U.S. federal executive department agencies is decreasing in the ideological congruence between presidents and their appointed cabinet secretaries. Although this latter approach analyzes the individual-level agent traits of agency leaders in the form of ideological congruence with politicians, it does not consider the full domain of agent compliance in hierarchical settings. Specifically, existing studies omit the fealty aspect of bureaucratic compliance derived from shared organizational identity, which is driven by either internal or external rewards. Recent research on this topic also fails to consider the organizational context in

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[1] The use of mean proportion of appointed political executives in a given agency through time is a limited measure since it effectively represents an agency-level "fixed effect" that exhibits only between-agency variation by construction.

which budgetary decisions are made, as well as fails to distinguish between presidential and congressional revealed budgetary preferences (but see Krause and Cook *Nd.*).

In this study, a theory of dual coordination dilemmas is advanced to understand how bureaucratic leadership can mediate horizontal coordination problems between political principals (i.e., common agency), as well as vertical coordination problems between political principals and administrative agencies. The core insights generated from this theory are threefold. First, bureaucratic leadership can engender greater political support for an agency only when the agency's policy mission is incongruent with the policy interests of the political principal, and both principals' policy interests are aligned. Second, when political principals' policy interests are discordant, bureaucratic leadership cannot resolve policy conflict between a political principal and agency. Finally, problems of common agency that embody separation of powers oriented conflicts not only provide effective checks and balances between multiple political principals (e.g., Acemoglu, Robinson, and Thorvik 2013; Persson, Tabellini, and Roland 1997), but also serve as a binding constraint on each principal's efforts at overcoming their policy conflict with agencies.

Theoretical propositions derived from this "Dual Coordination Dilemmas" logic are tested using panel data on 31 U.S. federal government agencies from FY 1978 to FY 2009. Most critically, these tests use a novel generalized latent trait measure of bureaucratic leaders' "loyalty" to their appointing president developed by Krause and O'Connell (2014, 2015) that capture agent (presidential) loyalty for chief political executives (i.e., agency head or independent regulatory commission chairperson) managing these government agencies during this period. The statistical evidence shows that an agency's budgetary support is increasing in the agency leader's loyalty to the president only when an agency's policy mission conflicts with a

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given political principal during unified party government. Further, "conflictual" agencies'

comparatively greater budgetary support under divided party government vis-à-vis unified party

government is decreasing in the agency leader's loyalty to the president. When institutional

policy conflicts exist between political principals, agency leadership cannot effectively resolve

such conflicts between politicians and agencies. On a broader level, these findings suggest that

bureaucratic leadership matters most for obtaining political support for their agencies when they

exhibit either relatively low or high levels of presidential loyalty.

The next section presents the theoretical logic, while the third section discusses the data,

variables, and methods. The empirical findings are presented in the fourth section. The paper

ends with a discussion regarding how this study enhances our understanding of bureaucratic

politics, as well as its broader implications for analyzing both vertical and horizontal

coordination dilemmas in the realm of democratic governance.

A Theory of Dual Coordination Dilemmas in the Study of Bureaucratic Politics

This study seeks to make sense regarding the pivotal role of agency leadership for

understanding how it affects the cultivation of political support for the bureaucratic organizations

that they are responsible for guiding. To do so, one must consider the fact that agency leaders

serve as politically appointments whose tenures are almost always much more short-lived

compared to the politicians charged with managing and overseeing them from above, as well as

the layers of political executive and career executives directly underneath them who are charged

with implementing policy (e.g., Aberbach and Rockman 2000; Heclo 1977). Agency leaders'

role in democratic governance thus represents a conduit between political principals and

administrative organizations (Kaufman 1981; Wilson 1989: Chapters 10-12). In this sense,

agency leaders are the fulcrum that resides between the interface of politics and administration.

More specifically, agency leaders seek to engender political support while operating in an agency with a core policy mission that is anchored in organizational considerations such as norms (Wilson 1989) and reputations (Carpenter 2001, 2010), and how they are manifested in both the provision and application of administrative policy expertise. In a nutshell, the thesis advanced below asserts that bureaucratic leadership can only engender greater political support for an agency when two conditions are met: (1) the agency's core policy mission is in conflict with a principal's policy interests; and (2) both principals' policy interests are aligned with one another.

Theoretical Logic & Testable Empirical Implications

The theoretical logic advanced here rests on three general assumptions relating to common agency problems in organizational settings. First, principals wish to offer relatively less support for those organizations that they are in conflict with compared to those that they are not, all else being equal (**Assumption 1**). This means that principal support of the organization is increasing in preference alignment, net of any bargaining and transaction costs that they may incur. Second, a loyal agent reduces moral hazard or agency loss on behalf of the principal (**Assumption 2**). That is, a loyal agent, through some combination of shared preferences or fealty, will be more faithful in carrying out the will of the principal than a less loyal counterpart. Finally, the nature of a principal's support for an organization is affected by whether their interests are aligned or discordant with a competing principal (**Assumption 3**). To be precise, divided principals cannot influence an organization's activities as effectively as when they act in a unified manner.

Given these assumptions, when problems of common agency are resolved between political principals (e.g., a single political party controls all democratic institutions in a

separation of powers system), each principal will find it in their (joint) best interests to closely link their support to a discordant organization based on the degree of loyalty exhibited by the agent leading the organization. Principals' support for aligned organizations, however, will not be contingent upon the loyalty of the agent leader. The logical basis for these claims rests on the fact that both principals have much to gain working together by leveraging support from a discordant agency, based on the individual serving as the intermediary between themselves and the organization. On the other hand, an organization that is not in conflict with either principal will gain very little "value-added" support from having a loyalist or independent serving as its leader. This is because the principal has weak incentives to condition their support on leader loyalty since the organization's compliance is structurally sufficient when it comes to being supportive or malleable to the principal's interests. Put another way, organizational leadership makes a difference only if it can sufficiently impact the principal's utility.

More concretely, if a political principal wishes to offer less support for a discordant agency, all else being equal (**Assumption 1**), obtains positive utility from a loyal agency leader (**Assumption 2**), and (3) shares the same policy interests as a competing political principal (**Assumption 3**), then it naturally follows that *both* political principals' support of an agency will be increasing in the loyalty of the agency leader to the appointing principal (P1) for conflictual agencies. This logic yields the theory's first proposition:

> **Proposition 1:** *When an Appointing Principal (P1) and Competing Principal (P2) are aligned, and P1 & P2 exhibit conflict with the Organization (O), then both P1 & P2's support of O will be **increasing** in the agent leader's loyalty to P1.*

Proposition 1 asserts that agent loyalty to the appointing principal in the presence of vertical conflict between the principal and organization can be used to counterbalance this

vertical coordination problem jointly shared both principals in relation to the agency's policy

mission. This proposition yields a pair of testable hypotheses:

>**Hypothesis 1a (H1a)**: *In times of unified party government, agency leadership loyalty to the president results in **<u>higher</u>** levels of political support afforded by both the president and Congress for conflictual agencies vis-à-vis non-conflictual agencies.*

>**Hypothesis 1b (H1b)**: *In times of unified party government, the difference in both the president's and Congress's political support for conflictual agencies vis-à-vis non-conflictual agencies is **<u>increasing</u>** in agency leadership loyalty to the president.*

Recall from **Assumption 3**, however, that the nature of a principal's support for an

organization is affected by whether their interests are aligned or discordant with a competing

principal. In the opposing common agency situation, when political principals are in conflict

with one another (e.g., divided party government), each principal (P1 & P2) will constrain the

other by offsetting one another's capacity to offer greater (lesser) support to a discordant

organization based on it being led by a loyalist (independent) to the appointing principal (P1).

Although P1 may wish to increase support for a discordant organization (O1) headed by a

loyalist of their own, P2 may wish to decrease support for that discordant organization because

the leader's loyalty is to P1. Under these circumstances, the combination of *both* horizontal and

vertical conflicts translates into the organization's leadership possessing little, if any, bearing on

the support that it receives from *either* political principal. This logic generates the second

theoretical proposition:

>**Proposition 2:** *When an Appointing Principal (P1) and Competing Principal (P2) are in conflict, and P1(P2) exhibits conflict with Organization O1 (O2), then both P1 & P2's support of O1 (O2) will be orthogonal to the agent leader's loyalty to P1.*

Proposition 2 simply means that because the degree of loyalty displayed by an agent leader in O1 can yield benefits for P1 that are not enjoyed by P2, and vice-versa with respect to O2's agent leader. Therefore, each principal is effectively constrained from altering their support for an organization based on the nature of its agent leader. This logic produces a second distinct pair of testable hypotheses:

> **Hypothesis 2a (H2a)**: *In times of divided party government, agency leadership loyalty to the president results in **no difference** in the level of political support afforded by either the president or Congress for respective conflictual agencies vis-à-vis non-conflictual agencies.*

> **Hypothesis 2b (H2b)**: *In times of divided party government, the difference in both the president's and Congress's political support for conflictual agencies vis-à-vis non-conflictual agencies is **unaffected** by agency leadership loyalty to the president.*

Taken together, an implication that naturally follows from **Propositions 1 & 2** is that each principal (P1 & P2) should offer comparatively greater (lesser) support to a discordant organization when its leader is more (less) loyal to P1 when the principals' interests are aligned compared to when they are opposed. In turn, this intuition implies the following corollary to **Propositions 1** & **2**:

> **Corollary to Propositions 1 & 2:** *P1 & P2's support of O1 (O2) will be more contingent upon an agent leader's loyalty when P1 & P2 are aligned (i.e., O1 = O2) compared to when they are in conflict with one another (i.e., O1 ≠ O2).*

This corollary accounts for the simple notion that the marginal difference involving each principal's support for conflictual versus non-conflictual organizations will be comparatively greater (lesser) when agent leader loyalty is higher (lower) when principals are in conflict with

one another compared to when they are not. This intuition translates into the following straightforward empirical implications:

> **Hypothesis 3a (H3a)**: *The effect of agency leadership loyalty to the president on political support afforded by both the president and Congress for conflictual agencies compared to non-conflictual agencies is **<u>lower</u>** under divided party government than unified party government.*

> **Hypothesis 3b (H3b)**: *The difference in political support afforded by both the president and Congress for conflictual agencies vis-à-vis non-conflictual agencies under divided party government versus unified party government is **<u>decreasing</u>** in agency leadership loyalty to the president.*

On a normative level, the dual coordination dilemma theory advanced here highlights the limits of resolving vertical coordination problems between a principal and agent when multiple principals are divided. Specifically, common agency does not merely offer a standard separation of powers check between the executive and legislative branches as commonly understood by students of institutional politics, but also provides a challenging obstacle for coordination within the executive branch, as well between the legislative branch and bureaucracy. Next, the hypotheses emanating from this theoretical logic are empirically tested.

Data, Variables, and Methods

These empirical predictions derived from the theory are analyzed using a panel data design comprised of presidential budgetary requests and resulting congressional appropriations for 31 U.S. federal government agencies from fiscal years 1978 to 2009. Because the hypotheses focus either on the president or on Congress, we construct two dependent variables. Presidential budgetary support for U.S. federal agencies is measured as the real growth from the preceding

year in the president's budget request for a given agency – i.e., [*ln* (president's request for fiscal year *t* for agency *i*) – *ln*(president's request for fiscal year *t-1* for agency *i*)]*100. Similarly, Congressional budgetary support of U.S. federal agencies is measured in analogous terms as [*ln*(congressional appropriation for fiscal year *t* for agency *i*) – *ln*(congressional appropriation for fiscal year *t-1* for agency *i*)]*100.

[Insert Table 1 About Here]

The primary covariate of interest is a measure of agency leader loyalty to the president who picked them (**Agency Leader Loyalty: President**). This measure includes both shared political orientation (inferred from shared partisanship with the appointing president and political investment via campaign contributions made to the appointing president *prior* to nomination) and fealty reflecting the ability to be a "team player" in the organization (inferred from past service to a political party organization or elected office).[2] The measure departs from existing measures relying solely on individual bureaucrats ideology (Bertelli and Grose 2009, 2011; Bonica, Chen, and Johnson *Nd.*; Chen and Johnson 2015; Clinton et al., 2012; Nixon 2004) since agent compliance relies on more than shared ideological preferences in hierarchical relationships. Specifically, agents may want to comply because of fealty to the organization, which may derive from implicit incentives surrounding career concerns (e.g., Adolph 2013; Alesina and Tabellini 2007; Dewatripont, Jewitt, and Tirole 1999; Hallerberg and Wehner 2013). In addition, agents may care about their organizational identity as a "team player" where they serve an assigned role and function within the organization (e.g., Akerlof and Kranton 2005; March and Simon 1992).

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[2] Although these measures are observed *ex ante* to bureaucratic leaders' actual appointive service, these traits represent durable agent characteristics that are rooted in their observable behavior over a lengthy period of time (see Krause and O'Connell 2014, 2015). Further, unlike this measure, existing individual-level agency ideology scores suffer from post-treatment biases since these measures entail observation(s) conducted *ex post* to their selection. See King (2010) for an excellent summary of the problems associated with post-treatment bias in political science applications.

In the study of the American presidency, Lewis Gawthrop (1969: 143), for example, asserts that

an appointee's propensity for compliance to the president and the president's programmatic goals

relies upon the appointee's individual characteristics. Stephen Hess (1988: 183) notes that

loyalty for personnel serving under the president is a critical factor to offset the centrifugal

pressures emanating from external audiences such as Congress and interest groups. Because

serving in a subordinate position within an organization comes with intrinsic responsibilities

(Weber 1914 [1978]: 959), bureaucratic compliance can be obtained even in the absence of

preference alignment between the president and agency official.

This loyalty measure is constructed from an original biographical database of upper-

echelon Senate-confirmed political executives who served in U.S. federal government agencies

between 1977 and 2008 (Krause and O'Connell 2014, 2015).[3] The specific measure of interest is

the normalized loyalty score ($Z_{Loyalty}$) for each agency leader based on their Bayesian posterior

median factor score estimates generated from a generalized latent trait analysis estimated using

Bayesian MCMC methods (see Krause and O'Connell 2015 for more details).[4] These agency

leader loyalty scores are operationalized in terms of a broader pool of upper-echelon PAS

political executives included from the full sample of appointed individuals in Krause and

[3] The indicator variables used to generate agent loyalty to the president estimates are as follows: *Shared Political Orientation:* (1) whether the appointee shared the same party affiliation as the nominating president; (2) whether the appointee gave any monetary campaign contributions exceeding the FEC reporting limit to the nominating president; *Fealty (Shared Partisan Organizational Identity via Elective Office, Administrative or Organizational Duties):* (3) whether a shared partisan affiliation appointee previously served in an appointed (Senate confirmed or not) full-time position in any agency during a preceding administration (signifying administrative service reflecting partisan loyalty that transcends the appointing president); (4) whether the appointee had previous elective office experience; (5) whether the appointee had any experience working for a national organization for the party of the president; and (6) whether the appointee served in state government when the nominating president was governor.

[4] This statistical technique involves Bayesian MCMC estimation of a three factor confirmatory structural equation model (containing uninformative priors) with correlated measurement errors among the three latent traits/factors: loyalty, managerial competence, and policy competence. More details can be found in Krause and O'Connell (2014; 2015: *Measurement Model Appendix*).

O'Connell (2014, 2015). For the analysis here, this measure of agent loyalty for agency heads

and chairpersons is lagged one year to avert any potential endogeneity bias attributable to

political support for an agency based on the selection and confirmation of an agency head. In

other words, the lagged measure ensures that agency heads were chosen prior to the advent of the

annual budgeting process such that any behavior from politicians following appointment is not

endogenous with respect to loyalty and competence.

The second key covariate of interest for testing the "dual coordination dilemma" theory is

whether a president and agency exhibit inherent policy conflict arising from the partisan control

(by the president and Congress separately) and the ideological nature of the agency's policy

mission based on a discrete 95% Bayesian posterior credibility interval classification of agency

ideological scores advanced by Clinton and Lewis (2008) into liberal, moderate, and

conservative agencies (**Political Principal-Agency Conflict**). For the president, a dummy

variable capturing president-agency conflict equals 1 for agency i in calendar year $t-1$ if the

president is a Democrat and the agency mission is conservative or if the president is a

Republican and the agency mission is liberal, and 0 otherwise. Similarly, a congressional-agency

conflict measure is constructed where it equals 1 if for agency i in calendar year $t-1$ when both

chambers of Congress are controlled by the Democrats and the agency mission is conservative or

both chambers of Congress are controlled by the Republicans and the agency mission is liberal,

and 0 otherwise.

Divided Party Government is a dummy variable that takes the value of 1 if the White

House, House, and Senate are not controlled by the same party and 0 otherwise. This covariate is

lagged for interactions with the other two measures for consistency purposes, as well as for

statistical models explaining presidential budget requests given the staggered nature of the

OMB's budgetary process, which begins in the Autumn of the preceding calendar year. To test the empirical implications derived from the theory, a series of interaction variables among the agency leader characteristics and agency mission incongruence variables under both unified and divided party government are created (with hypothesized coefficient signs inside parentheses): **Agency Leader Loyalty: President × Political Principal- Agency Conflict** (−); **Agency Leader Loyalty: President × Divided Party Government** (+); **Political Principal-Agency Conflict × Divided Party Government** (+); and **Agency Leader Loyalty: President × Political Principal-Agency Conflict × Divided Party Government** (−).

Additional covariates are incorporated into the model specifications to account for presidential priorities, election timing, party control, macroeconomic conditions, and connected appropriations information. Presidential policy priorities may affect political budgetary support. Hence, this possibility is accounted for by the number of mentions of policy issues directly relevant to agency i in the State of the Union address in fiscal year t (**State of the Union Count**).[5] If presidents' stated policy priorities have any sway on budgetary decisions, then mentions of policy issues under an agency's jurisdiction should produce higher budgets. On election timing, because members of Congress have greater incentives for getting funding for their districts (Mayhew 1974), a binary indicator measure is included to account for whether a congressional election (whether mid-term or presidential year) occurs (**Congressional Election**

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[5] We first went through each State of the Union address and listed all separate policy issues mentioned. For 1977, because President Carter did not give a State of the Union address, we used his speech to the Democratic Convention when he accepted the party's nomination. For each policy issue, we then coded up to three agencies connected to that issue. If an issue involved a sub-agency within an agency (for example, the U.S. Army within the Defense Department), we coded both entities. Each co-author assigned agencies to each issue separately and then we discussed cases where we disagreed to come to a consensus on what agencies should be coded.

Year). Funding is posited to be higher in congressional election years. Because changes in party

control result in changes in policy priorities, we include a dummy variable that accounts for

partisan changes in the White House. This measure equals 1 (−1) in the first year of a

Democratic (Republican) administration replacing a Republican (Democratic) counterpart, and 0

otherwise (**Presidential Party Change**). An additional binary indicator measure is

operationalized in the same manner for the first year following changes in majoritarian control of

at least one chamber of Congress such that it takes on a value of 1 (−1) when Democrats

(Republicans) gain a majority of at least one chamber, and 0 otherwise (**Congressional Majority**

Party Change). Partisan institutional change favoring the Democrats should create a boost in

budgetary support for government agencies, all else equal. Each agency falls under one of the

House Appropriations Subcommittees; because the experience of the relevant subcommittee

chair can shape the president's budget request, we include the number of years the relevant chair

has served in that capacity (**House Appropriations Subcommittee Chair Experience**).[6]

Certain macroeconomic conditions that may influence political budgetary choices must

be accounted for in the statistical analyses. The unemployment rate is operationalized as the

seasonally-adjusted lagged average unemployment rate from the July to December period

preceding when the president submits his budget to Congress (**Unemployment Rate**).[7] Higher

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[6] This set of control covariates are lagged by one year in the presidential budget request model, and
entered contemporaneously in the congressional appropriations model given the temporally staggered
nature of the budgetary process noted previously. This is done similarly in previous scholarship analyzing
presidential and congressional budgetary decisions separately (e.g., Kiewiet and McCubbins 1991:
Chapter 8). We thank Jon Woon for graciously supplying us with his House Appropriations
Subcommittee data used to calculate the chair experience variable.

[7] Data were collected from United States, U.S. Department of Labor, Bureau of Labor Statistics, *The
Employment Situation: Civilian Unemployment Rate*. Washington: GP0, 2010-05-07 release.

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unemployment should produce a greater willingness for public spending. For the government budget deficit/surplus, thus models incorporate a lagged measure of annual government budget deficit or surplus as a percentage of GDP (**U.S. Federal Budget Government Surplus (+) / Deficit (−)**).[8] The expected sign associated with this coefficient is ambiguous since although higher fiscal deficits should result in greater austerity, spending may actually rise if the government highly discounts the social welfare costs of budget deficits. In addition, shifting budget rules and ancillary features of the budgetary process pertaining to fiscal conditions may impact presidential and congressional budgetary decisions. Because the Gramm-Rudman-Hollings Act (and subsequent legislation) placed limits on domestic spending from fiscal years 1986 to 1991, a GRH Act dummy variable is specified that takes the value 1 for any domestic agency in fiscal year t, if t is between 1986 and 1991 – which should yield a negative coefficient (**Gramm- Rudman-Hollings Act**).[9] To gauge presidential expectations for the current year's budget process based on the previous year's outcomes, a measure of the preceding year gap between the actual appropriation for agency i and the president's budget proposal for agency i, calculated as a logged percentage difference between these two figures from fiscal year t-1 (**Lagged Appropriations−Request Gap**). Because the supplemental appropriations process yields additional funding for an agency, a lagged dummy variable for whether agency i received at least one supplemental appropriations in fiscal year t-1 (**Supplemental Appropriations**).

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[8] Data were collected from United States, Office of Management and Budget, *Budget of the United States Government (Historical Tables): Fiscal Years 1976-2009*. Washington: GPO, 1975-2009.

[9] This measure is lagged by one year in the presidential budget request model, and entered contemporaneously given the temporally staggered nature of the budgetary process noted previously.

When an agency has obtained supplemental appropriations in the preceding year, it is posited that they should receive less funding support in the current year, all else equal.

Given the panel features of the data design, and potential unobserved heterogeneity across agencies and presidential administrations, all statistical models control for both cross-sectional agency and presidential administration unit effects. In addition, all standard errors and covariances employed in hypothesis testing are generated from 1000 bootstrap replications, with random resampling clustered by agency to allow for agency-based dependence in the estimates.

Empirical Findings

Estimates from the regression models appear in **Table 2**. **Model 1** examines presidential budget request decisions; **Model 2** (***OLS^a***) analyzes congressional appropriation decisions ignoring potential endogeneity bias stemming from contemporaneous fiscal year presidential budget requests; **Models 3-5** demonstrate that endogeneity bias is problematic, and hence, employ alternative instrumental variable (IV) model specifications to address this issue. **Model 3** (***2SLS-IV^b***) uses the preceding year's presidential budget request growth as an instrument, as well as excluded 'non-unique' instruments in the presidential budget request equation (**Model 1**); **Model 4** (***2SLS-IV^c***) employs a pair of 'unique' instruments covering the two preceding years' of presidential budget request growth, as well as excluded 'non-unique' instruments in the presidential budget request equation (**Model 1**); and **Model 5** (***2SLS-IV^d***) utilizes a second moment transformation of the endogenous regressor as a 'unique' instrument following the moments method of Lewbel (1997), in conjunction with excluded 'non-unique' instruments in the presidential budget request equation (**Model 1**). Although all three sets of instruments for each model's reduced form regression equation are statistically significant at conventional levels

of significance, it is clear that the instrument vector for **Model 3** is superior given that the one-

year lag of presidential budget request growth is the most important instrument in terms of

individual predictive strength compared to other 'unique' instruments, its marginal contribution

to the 'non-unique' excluded instrument list, and the efficiency of the standard error estimates.[10]

In all three reported IV models, the null hypothesis that presidential budget request growth is

exogenous to congressional appropriations is rejected at the $p < 0.05$ level (*Endogeneity Bias*),

while the Sargan-Hansen J-statistic testing for exclusionary restrictions based on model

overidentification fails to reject the null hypothesis that the instruments do not *directly* impact

congressional appropriation decisions at $p \leq 0.10$.[11] In turn, these IV model diagnostic test

results indicate that **Models 3-5** successfully purge endogeneity bias from these models'

estimates, while **Model 3** produces the most parsimonious (efficient) set of structural equation

estimates. Because the theory's predictions are directional in nature, one-tailed significance tests

are employed, unless noted otherwise. The remaining discussion is primarily restricted to the

core statistical findings.

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[10] The joint-F tests of instrument strength appearing at the bottom of **Table 1** are for all instruments. Analysis of the individual importance of the 'unique' instruments reveals that the only one that singularly has a $\chi^2 \sim (1)$ statistic exceeding 10 is the one-year lagged presidential budget request growth instrument (11.02), and that in **Model 4**, the exclusion of this particular instrument has a $\chi^2 \sim (1)$ statistic equal to 21.13, while separate exclusion of this covariate's second lag yields a $\chi^2 \sim (1)$ statistic equal to 6.66. In addition, a separate model containing only 'non-unique' instruments that appear solely in the presidential budget request equation reveals inadequate strength at even less demanding conventional significance levels ($\chi^2 \sim (7) = 11.37$, $p = 0.123$). Sole reliance on 'non-unique' instruments employed for this non-reported model are therefore more problematic in terms of both bias and efficiency than the alternative 2SLS-IV models reported in the manuscript.

[11] The *Endogeneity Bias* test involves a control function method for assessing whether the residuals from the IV equation are orthogonal to congressional appropriation decisions (structural equation). The *Exclusionary Restrictions* test is employed to provide evidence that the collective set of instruments do not directly affect congressional appropriation decisions through the latter's residual term.

Model 1 reveals that the loyalty of agency leaders to presidents has no substantive bearing on presidential budgetary support in non-conflictual agencies under unified party government (*Agency Leader Loyalty: President*: −1.927). Presidential-agency conflict generates nearly a 16% lower funding request, on average, compared to federal agencies whose policy mission is not at ideologically odds with the president under unified party government (*Political Principal-Agency Conflict*: −15.759). Non-conflictual agencies headed by the weakest presidential loyalist observed in our sample fare neither better nor worse in times of divided party government compared to when the president and both chambers of Congress are controlled by the same party (*Divided Party Government*: 0.175). In addition, for each one percent that appropriations outcomes are more generous than budget requests in the preceding budget cycle, the president seeks an average of 0.34% additional agency funding in the current cycle (*Lagged Appropriations−Request Gap*: 0.340).

[Insert Table 1 About Here]

Model 2 is the congressional appropriations growth equation that ignores endogeneity bias attributable to the contemporaneous presidential budgetary requests. **Models 3-5**, which account for this source of endogeneity bias, reveal that presidential loyalty of agency leaders yields an average reduction in legislative funding growth by about 2.7% for those agencies whose policy mission is not in conflict with the party controlling both chambers of Congress under unified party government (*Agency Leader Loyalty: President*: −2.757, −2.722, & −2.743). Legislative-agency conflict yields roughly between a 26.5%-29% per annual average cut in appropriations compared to federal agencies whose policy mission is not at ideologically odds with Congress under unified party government (*Political Principal-Agency Conflict*: −28.571, −26.498, & −29.067). Non-conflictual agencies led by the weakest presidential loyalist observed

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in our sample obtain anywhere from roughly a 9% to 13% increase in legislative funding in times

of divided party government compared to when the president and both chambers of Congress are

controlled by the same party (*Divided Party Government*: 9.633, 12.420, & 9.129). In addition,

congressional election years, as well as a partisan switch from a Republican administration to a

Democratic one, yield at least marginally significant increases in congressional appropriations

growth in **Models 2-4**.

Influence of Political Principal-Agency Conflict on Budgetary Decisions

      Figure 1 displays the effect of agency leader loyalty to the president under alternative

common agency relationships between political principals, as well as vertical relationships

between a political principal and an agency. **Figure 1A** displays the average impact that an

agency leader's loyalty to the president exerts on presidential budget request growth for non-

conflictual agencies under unified party government [*Non-Conflictual: UPG*: -1.926%, $p =$

0.491, two-tailed test]. This effect is 4.702% ($p = 0.082$, two-tailed test) for conflictual agencies

under these political circumstances (*Conflictual: UPG*). Consistent with **H1a**, this difference is

both positive and statistically significant [*H1a: Difference: UPG:* 6.629%, $p = 0.049$]. Although

agent loyalty to the president generates a modest increase in executive funding support in the

absence of agency conflict under divided party government [*Non-Conflictual: DPG*: 1.78%, $p =$

0.128, two-tailed test], it results in effectively no change in presidential budget requests in the

presence of agency conflict [*Conflictual: DPG*: -0.019%, $p = 0.993$, two-tailed test]. The

difference between these two scenarios is -1.80% ($p = 0.398$, two-tailed test), and thus the null

hypothesis cannot be rejected as predicted by **H2a**. According to **H3a**, agency leadership loyalty

to the president will result in a lower presidential funding differential for conflictual agencies

(compared to non-conflictual agencies) under divided party government (compared to unified party government). The evidence from presidential budget requests supports this hypothesis as presidents' request about a 8.50% (p = 0.042) lower funding differential between conflictual and non-conflictual agencies in times of divided party government. Put simply, agencies whose core policy mission is at odds with occupant of the White House (*vertical conflict*), when executive and legislative branches exhibit partisan divisions (*horizontal conflict*), are best off being led by an individual with little apparent loyalty to the president.

[Insert Figure 1 About Here]

Figure 1B entails testing the same theoretical hypotheses with respect to congressional appropriation decisions based on **Model 3** statistical estimates (with criteria noted on **Pages 16-17** & **Note 10**). Agency leader loyalty to the president adversely impacts legislative funding growth when Congress has no conflict with the agency's core policy mission under unified party government [*Non-Conflictual: UPG*: −2.76%, p = 0.194, two-tailed test]. Conversely, such agent loyalty yields big pecuniary dividends for conflictual agencies under unified party government as their congressional appropriations rise by an average of 7.28% (p = 0.097, two-tailed test). In terms of **H1a**, this difference constitutes a 10.04% (p = 0.015) more favorable budgetary outcome for conflictual agencies compared to their non-conflictual counterparts that can be attributed to their leaders' presidential loyalty during times of unified party government. Analysis of **H2a** reveals that there is no significant difference in legislative funding behavior attributable to agency leaders' loyalty to the president between conflictual and non-conflictual agencies under split partisan control of the executive and legislative branches (2.871%, p = 0.519, two-tailed test). Finally, the differential impact of agency leadership presidential loyalty on congressional funding decisions between conflictual and non-conflictual agencies is 7.169%

(p = 0.066) lower under divided party government compared to unified party government. Once again, this provides direct empirical evidence in support of **H3a**. Both presidential and congressional budgetary behavior indicate that conflictual agencies led by a presidential loyalist are rewarded in terms of political support when the president and Congress exhibit partisan alignment, while conflictual agencies headed by a non-loyalist leader fare comparatively better when political principals are in partisan opposition to one another.

The Conditional Effect of Agency Leader Loyalty to the President on Budgetary Decisions

Figure 2 displays the tests of theoretical hypotheses **1b, 2b,** and **3b** that examine the conditional marginal conflict of conflictual agencies on political budgetary support, conditional on agent loyalty to the president under both divided and unified party government regimes. **Figure 2A** reveals convincing support for **H1a** insofar that during times of unified party government, a nearly 30% annual differential increase is observed in presidential budget request growth for agencies whose policy mission is at odds with the president as one moves from the least loyal to most loyal agency leader in the sample.

Under divided party government, the theory predicts that agent loyalty to the principal should not bear any consistent impact on support between conflictual and non-conflictual organizations (**P2**). The empirical pattern in **Figure 2B** indicates that presidential budgetary support slightly wanes in agency leader loyalty in the presence of both horizontal (divided party government) and vertical (conflictual agencies) institutional policy conflict. The total range effect of agency leader loyalty to the president on presidential budgetary support under divided party government is slightly more than a quarter of the magnitude effect for unified party government ([8.04 / 29.60]*100 = 27.2%). These effects are not different from zero (i.e., non-conflictual agencies baseline) at conventional significance levels based on two-tailed tests. In

tandem, these results yield supportive evidence for **H2b**, while also being modestly suggestive of

presidential acquiescence to Congress in the presence of a dual coordination dilemma.

Consistent with **H3b**, the statistical evidence in **Figure 2C** demonstrates that the

presidential-agency conflict differential involving presidential budgetary support under divided

versus unified party government is decreasing in agency leader loyalty to the president. The

presidential budget request growth is at its apex when agency leader loyalty to the president is at

its weakest (17.54%, $p = 0.071$) and at its lowest for the strongest presidential loyalist leading an

agency in this sample (-20.09%, $p = 0.033$). Put simply, agencies only obtain strong budgetary

support under the dual coordination dilemma when their appointed leaders neither exhibit shared

policy orientation with nor fealty to their appointing president.

<center>**[Insert Figure 2 About Here]**</center>

Congressional appropriation decisions are also analyzed in testing this set of theoretical

hypotheses in **Figures 2D-2F**. Under unified party government, **Figure 2D** reveals that an

agency leader who is least loyal to the president will obtain an average reduction of 28.57% ($p =$

0.019, one-tailed test) budgetary growth each year if the agency's core policy mission is *jointly*

opposed by both the president and Congress compared to an agency not in conflict with either

political branch. At the other extreme, the strongest presidential loyalist agency leader will

garner 16.26% ($p = 0.038$, one-tailed test) additional legislative funding under the same

conditions when only a vertical conflict exists between Congress and the agency. This offers

more compelling support for **H1b** than what is found for presidential budgetary support.

Figure 2E uncovers much more gradual, as well as attenuated increases in congressional

funding for conflictual agencies with respect to agency leader loyalty to the president in periods

of divided party government (total range effect is 12.82%, $p \geq 0.415$, two-tailed test, in relation

<center>22</center>

to non-conflictual agencies baseline). Although this pattern is the mirror image of **Figure 2B**, thus suggesting that Congress is modestly acquiescing to the president based on its appropriation decision, it is nonetheless consistent with **H2b**. The null findings for **H2b**, coupled with the directional nature of these conditional relationships in **Figure 2E**, intimate that when confronting a dual coordination dilemma reflecting policy conflict between political principals, as well as with a government agency, both the president and Congress respond in a convergent manner consistent with the heavily constrained nature of their relationship. Hence, this pattern of political support for government agencies underscore the limits of agency leadership on bridging the policy divide between the executive and legislative branches.

Finally, **Figure 2F** shows that federal agencies in conflict with Congress receive much better funding outcomes from Congress under divided party government when the agency leader exhibits weak loyalty to the president, while effectively faring no better under unified party government as agency leader loyalty either equals or exceeds the 75th percentile value observed in the sample. Specifically, on average, agencies headed by the weakest presidential loyalist in the sample obtain 25.76% (p = 0.022) higher congressional funding in times of divided party government compared to unified party government. This average differential is 9.41% (p = 0.088) when the agency leader exhibits moderate (i.e., median) loyalty to the president. Unlike the evidence of **H3b** detected in presidential budgetary requests, congressional appropriation decisions exhibit a comparatively less generous political regime difference at higher levels of agency leader loyalty to the president.

Conclusion

From the start of the United States, politicians and commentators have focused on our system of separated but overlapping powers. As James Madison writes in *Federalist 47*: "*The*

several departments of power are distributed and blended in such a manner as at once to destroy all symmetry and beauty of form, and to expose some of the essential parts of the edifice to the danger of being crushed by the disproportionate weight of other parts." And from the start, the legislative and executive branches have shared a difficult, and often fractious, joint responsibility to provide direction and guidance to administrative agencies. Bureaucratic leaders play both a unique and vital role in democratic governance as the conduit between political principals and administrative organizations (Kaufman 1981; Wilson 1989: Chapters 10-12), these individuals are at caught in the vortex of both horizontal and vertical tensions in our political system.

This understanding of shared and separated powers arrangements informs modern applications of principal-agent theory to the study of bureaucratic politics. For instance, the analytical theoretical literature emphasizes not only the role that common agency plays in affecting the capacity of multiple political principals to influence a bureaucratic agent (Gailmard 2009; Volden 2002; Ting 2003), but also how an "agent's type" is critical for understanding to what extent the principal is willing to entrust policymaking responsibility to an agent (Bendor and Meirowitz 2004; Gailmard and Patty 2013; Huber and McCarty 2004; McCarty 2004). In both analytical and empirical scholarship, defining an agent's type is routinely viewed either through the lens of bureaucratic agency's durable policy mission (Carpenter 2001; Clinton and Lewis 2008; Wilson 1989), or instead through those positions or individuals representing transient stewardship within an agency at any given point in time (Bertelli and Grose 2009, 2011; Hollibaugh, Horton, and Lewis 2014; Nixon 2004; Snyder and Weingast 2000)**.**

This study has set forth a dual coordination dilemma theory to better understand how political principals' support for bureaucratic agencies systematically varies by agency leadership in relation to *both* presidential-congressional relations (common agency) and political principal-

agency conflict. The theory advanced in this study yields a novel and critical implication for scholarship on bureaucratic politics. Specifically, agency leadership can only engender greater political support for the agency when two conditions are met. First, an agency's core policy mission must be in conflict with political institution's policy interests (e.g., Democratic President & Conservative Agency). This is because a political principal has little incentive to offer (additional) support to an agency whose policy mission is not at odds with them. Second, both political institutions' interests must be aligned with one another (unified party government). Otherwise, each political principal will provide an effective check on one another that will be reflected in their tepid (revealed) political support for the agency, irrespective of the individual leading that agency.

This study's empirical evidence provides compelling support for the theory through a statistical analysis of presidential budgetary requests and congressional appropriation decisions during a wide swath of the modern administrative presidency. Federal agencies whose policy mission is in conflict with either political principal during periods of unified party government obtain high pecuniary benefits from political principals by having a bureaucratic leader who exhibits strong loyalty to the president. These benefits are noticeably higher for these conflictual agencies vis-à-vis non-conflictual counterparts, as well as these benefits for conflictual agencies is increasing in agency leader loyalty to the president. As a result, presidents and Congress are effectively able to work in concert to overcome common agency problems that they encounter through executive branch coordination only when they are not in conflict with one another. Tangible differences in pecuniary benefits attributable to the agency leader do not exist between conflictual and non-conflictual agencies under divided party government. The extent to which the leader of a conflictual agency is loyal to the president reveals a modest decline in presidential

budgetary support and an analogous rise in congressional budgetary support. This empirical pattern of sluggish convergence in political support is indicative of the effectiveness of checks and balances between the political branches under these conditions. Finally, conflictual agencies during times of divided party government obtain comparatively better budgetary support when led by a weak presidential loyalist than a strong presidential loyalist.

In closing, this study suggests new directions for scholarly inquiry in bureaucratic politics. First, as Brehm and Gates (1997, 2008, 2015) have persuasively demonstrated, research that accounts for the interplay between individuals and bureaucratic organizations contains considerable promise for providing richer insights than more standard approaches which focus only on either aspect. In turn, this focus can enable scholars to get a better grasp on not only the dynamics of administrative governance, but also its implications for delegation and control of the bureaucracy by political principals. In this study, the interplay between organizational context and leadership provides us with a deeper understanding as to why politicians vary in their willingness to entrust government agencies with budgetary resources. Future research analyzing the political control of policy administration should begin to take seriously the stewardship characteristics of bureaucratic officials charged with policymaking responsibility. Subsequent studies along this line of inquiry possess considerable potential for greatly enhancing our scholarly understanding regarding the complexities of the administrative state in the realm of democratic governance.

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TABLE 1

Explaining Political Budgetary Support for U.S. Federal Agencies, FY 1978 – FY 2009
*(Fixed Effects Estimation with Bootstrapped Standard Errors, Random Resampling Clustered by Agency)*

Covariates	Budget Request Model 1 (OLS)	Appropriations Model 2 (OLS[a])	Appropriations Model 3 (2SLS-IV[b])	Appropriations Model 4 (2SLS-IV[c])	Appropriations Model 5 (2SLS-IV[d])
Agency Leader Loyalty: President	−1.927	0.214	−2.757*	−2.722	−2.743
	(2.800)	(2.133)	(2.125)	(2.196)	(2.968)
Political Principal-Agency Conflict	−15.759**	−12.090*	−28.571**	−26.498*	−29.067*
	(9.238)	(7.368)	(13.736)	(19.686)	(18.185)
Divided Party Government	0.175	15.431***	9.633**	12.420**	9.129
	(6.145)	(5.535)	(5.589)	(6.038)	(7.138)
Agency Leader Loyalty: President × Political Principal-Agency Conflict	6.629**	4.504*	10.133***	9.359**	10.008*
	(4.006)	(2.908)	(2.979)	(5.137)	(6.132)
Agency Leader Loyalty: President × Divided Party Government	3.707	0.056	3.105**	2.611**	2.970*
	(2.903)	(1.536)	(1.484)	(1.503)	(2.235)
Political Principal-Agency Conflict × Divided Party Government	17.539*	9.923	25.758**	22.756	25.507*
	(11.960)	(12.586)	(12.733)	(18.099)	(15.717)
Agency Leader Loyalty: President × Political Principal-Agency Conflict × Divided Party Government	−8.429**	−2.955	−7.169*	−6.389	−6.834
	(4.865)	(4.583)	(4.747)	(5.052)	(5.649)
Political Conditions					
State of the Union Count	0.199	−0.019	−0.042	0.035	−0.092
	(0.438)	(0.450)	(0.635)	(0.538)	(0.769)
Congressional Election Year	1.576	8.340*	7.722*	8.109***	7.612
	(2.046)	(5.280)	(5.483)	(3.336)	(6.002)
Presidential Party Change	4.468	21.573***	16.494*	17.257*	15.743
	(8.964)	(9.279)	(12.475)	(10.696)	(14.045)
Congressional Majority Party Change	1.057	−5.093*	1.043	−0.221	1.838
	(2.997)	(3.381)	(4.339)	(3.286)	(5.302)
House Subcommittee Appropriations Chair Experience	−0.413	0.093	0.183	0.218	0.202
	(0.460)	(0.503)	(0.646)	(0.546)	(0.715)
Macroeconomic and Fiscal Conditions					
Unemployment Rate	−1.758	−2.431	−3.335	−3.594	−3.383
	(1.817)	(2.414)	(3.387)	(2.042)	(3.725)
U.S. Federal Budget Government Deficit	−0.285	0.621	−0.075	−0.484	0.030
	(0.827)	(1.996)	(2.274)	(1.441)	(2.477)
Gramm-Rudman-Hollings Act	4.060	−4.485*	−4.093	−4.594	−4.445
	(3.646)	(3.168)	(4.152)	(3.955)	(4.562)
Lagged Appropriations−Request Gap	0.340***	——————	——————	——————	——————
	(0.141)				
Supplemental Appropriations	−1.851	0.821	−0.513	−0.616	−0.712
	(4.746)	(4.895)	(6.116)	(6.442)	(7.022)
Presidential Budget Request([a, b, c, d])	——————	0.131**	−0.692	−0.535	−0.715
		(0.066)	(0.432)	(0.278)	(0.712)
Model Diagnostics & Fit Statistics					
Overall R²	0.162	0.042	————	————	————
Overall Model Fit: (Wald χ²)	140.40***	134.89***	78.53***	123.39***	49.31***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Instrument Strength: χ² Statistic All Instruments	——————	——————	89.37***	123.39***	16.13**
			[0.000]	[0.000]	[0.041]
Endogeneity Bias: χ² Statistic (H₀: Pres. Budget Requests are Exogenous)	——————	——————	5.50**	3.88**	5.37**
			[0.019]	[0.049]	[0.021]
Exclusionary Restrictions: χ² Statistic: Sargan-Hansen J-Statistic	——————	——————	10.182	13.001	9.033
			[0.179]	[0.112]	[0.250]

Notes: Dependent variable for **Model 1** is Presidential Budget Request Growth i.e., positive values indicate spending increases from the year before, negative values indicate spending cuts. Dependent variable for **Models 2-5** is Congressional Appropriations Growth. Bootstrapped standard errors clustered by agency based on 1000 replications appear inside parentheses. Probability values appear inside brackets. Agency cross-sectional fixed effects and presidential administration fixed effects are included in all model specifications. [a]Actual Presidential Budget Request Growth in current fiscal year. [b] 'Unique' Instrument is Presidential Budget Request Growth from preceding year. [c] 'Unique' Instruments are Presidential Budget Request Growth from the previous two years. [d] 'Unique' Instrument is the second moment of Presidential Budget Request Growth in the current year (see Lewbel 1997).

*significant at the 0.10 level   **significant at the 0.05 level   ***significant at the 0.01 level (one-tailed tests).
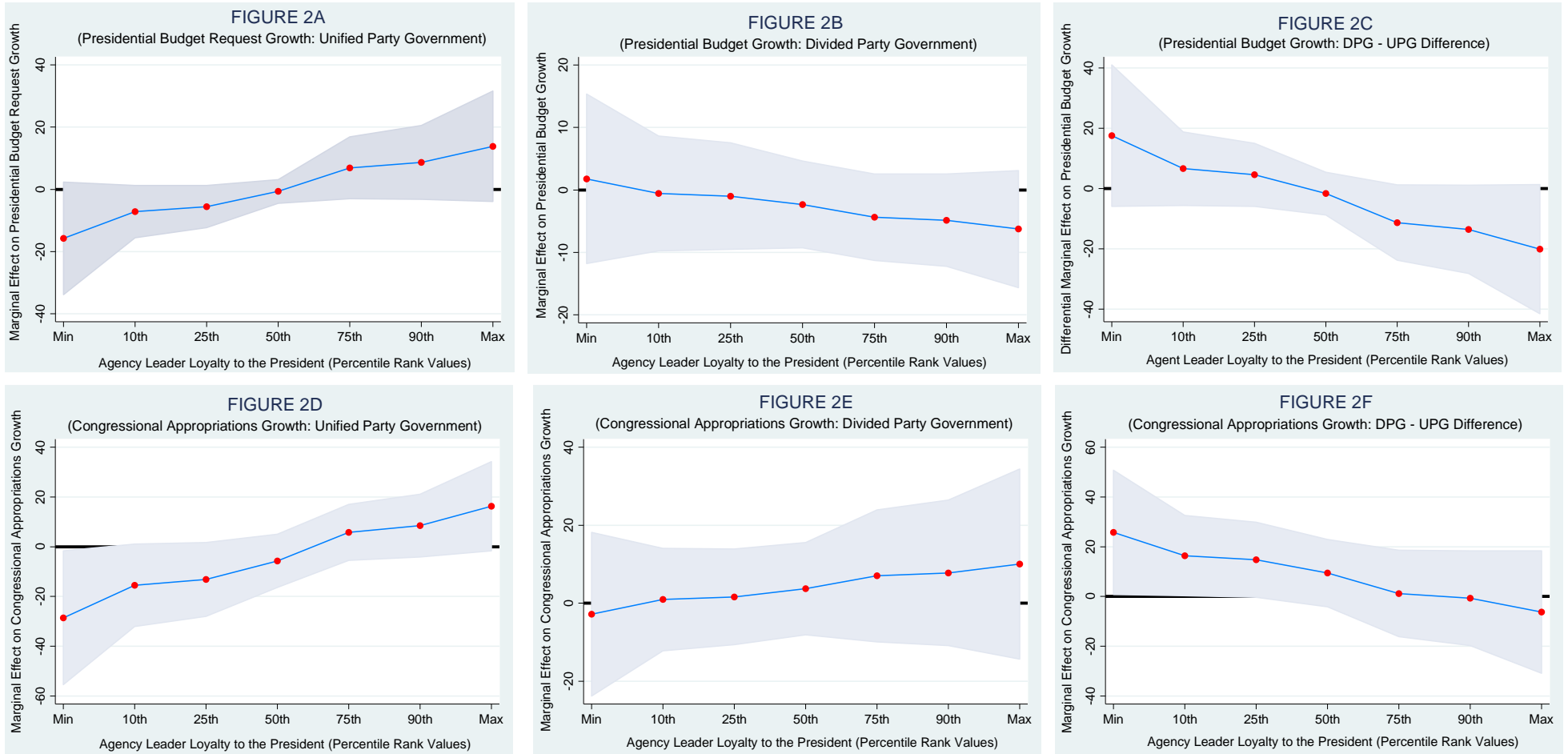
FIGURE 1

Marginal Effect of Agency Leader Loyalty to the President on Political Budgetary Support, Conditional on Alternative Horizontal and Vertical Relationships
(*Testing 'Dual Coordination Dilemma' Theoretical Hypotheses: H1a, H2a, & H3a*)

FIGURE 1A

Impact of Agency Leader Loyalty to the President on Presidential Budgetary Growth

FIGURE 1B

Impact of Agency Leader Loyalty to the President on Congressional Appropriations Growth
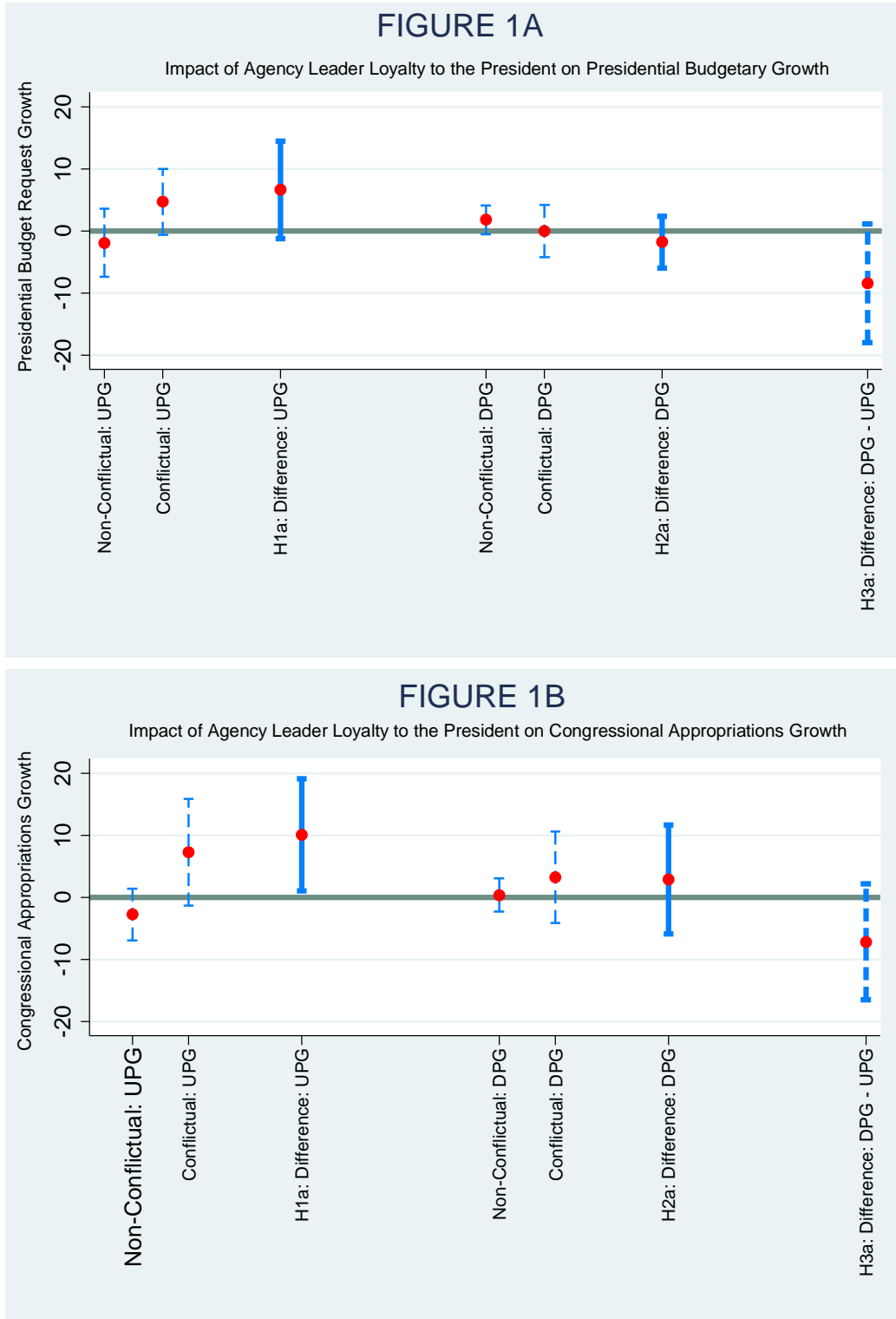
Note: *Line* and *circle dots* represent point estimates while *grey-shaded areas* represent 95% confidence bands.
Figure 1A is based on **Model 1** estimates, **Figure 1B** is based on **Model 3** estimates.

FIGURE 2

Marginal Effect of Political Principal-Agency Policy Conflict on Political Budgetary Support, Conditional on Agency Leader Loyalty to the President
(*Testing 'Dual Coordination Dilemma' Theoretical Hypotheses: H1b, H2b, & H3b*)

FIGURE 2A
(Presidential Budget Request Growth: Unified Party Government)

FIGURE 2B
(Presidential Budget Growth: Divided Party Government)

FIGURE 2C
(Presidential Budget Growth: DPG - UPG Difference)

FIGURE 2D
(Congressional Appropriations Growth: Unified Party Government)

FIGURE 2E
(Congressional Appropriations Growth: Divided Party Government)

FIGURE 2F
(Congressional Appropriations Growth: DPG - UPG Difference)

Notes: *Line* and *circle dots* represent point estimates, while *grey-shaded areas* represent 95% confidence bands surrounding point estimates. **Figures 2A-2C** are based on **Model 1** estimates. **Figures 2D-2F** are based on **Model 3** estimates.

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