Transparency, Performance, and Agency Budgets: A Rational Expectations Modeling Approach

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Existing research suggests that bureaucrats' optimal behavior is to maximize their agency's budgets, but does not account for information imperfections nor explore the tactics bureaucrats employ in maximizing their budgets. Drawing on the rational expectations literature, we propose a new theoretical model that describes the behaviors of politicians who, using imperfect information, judge an agency's performance, and bureaucrats who, by varying the agency's transparency, alter the degree of information imperfection and so influence the politicians' abilities to judge the agency's performance. We then fit data from the government's Performance Accountability Reports and the Scorecard data set to our model and obtain empirical results that are consistent with what our theoretical model predicts.

1. Agency Performance and the Growth of Government

The federal government's share of the US economy rose from 9% in 1927 to almost 30% in 2007, spawning numerous studies into the natures and causes of government growth. Niskanen (1971) introduces the idea of the self-interested bureaucrat who, using private information not shared by politicians, secures an inefficiently large budget. While Niskanen's conclusions have been debated extensively in the literature, perhaps due to a lack of data, bureaucrats' information advantages have been less so.

The goal of this analysis is to study the effect of information advantage on budget size by using newly available data on bureaucratic transparency as an inverse proxy for information advantage. By modeling transparency as a variable the bureaucrat can affect, this research incorporates imperfect information into the bureaucrat's budget-maximizing behavioral model. The resulting model is examined to gain insights into the bureaucrat's optimal behavior. Lastly, we use data on transparency and information relevance to test for the results that our theoretical model predicts.

Past researchers have attempted to explain the growth of government as a result of a complicated revenue structure that hides the full cost of government (Buchanan 1967; Goetz 1977; Pommerehne and Schneider, 1978), in terms of voter models (Downs 1957; Black 1958; Busch and Denzau 1977), and as a natural outcome of the institutions and procedures of the U.S. Congress (Ferejohn 1974; Fiorina and Noll 1978). Niskanen (1968, 1971, 1975) formally modeled the bureaucrat's behavior where the bureaucrat maximizes utility by maximizing his agency's budgets. He finds that bureaucrats succeed in enlarging their budgets because bureaucrats possess private information not available to

the politicians who set their budgets, and bureaucrats receive lump-sum budget appropriations rather than "per unit" appropriations.

Blais and Dion (1990) provide a summary of many criticisms of and modifications to Niskanan's model. Kogan (1973) and Margolis (1975) criticize Niskanen's model for its assumption that bureaucrats serve their own, rather than the public's interest. Migue and Belanger (1974) suggest that, to the extent bureaucrats would seek to maximize budgets, they would be primarily interested in maximizing their discretionary budgets (total budget minus minimum cost) rather than their total budgets. Rogowski (1978) claims that Niskanen's proposition of asymmetric information and the time required to overcome bureaucrats' expansionary tendencies holds only in the context of the American political system. Mackay and Weaver (1983, 1979) show that, depending on who has the power to decide on the public services mix and expenditure level, the conclusion of an inevitably growing budget does not always hold. While admitting that bureaucrats retain some informational advantages, Miller and Moe (1983) claim that there are numerous limits to those advantages, that politicians have their own advantages in the bargaining game, and that Niskanen exaggerates bureaucrats' bargaining power. Dunleavy (1985) argues that if Niskanen's logic is extended, it would suggest an end result of gigantic bureaucracies, which are rare for liberal democracies. Bendor et al. (1985) and Breton and Wintrobe (1975) claim that politicians will establish monitoring systems to compensate for bureaucrats' private information.

In support of Niskanen's general results, Bendor, Taylor and Gaalen (1985) construct a model in which bureaucrats face monitoring but at an unknown level. Their model shows that bureaucratic output moves closer to the efficient point when

bureaucrats are risk-averse but that, despite this improvement, budgets remain supra-optimal. Hood, Dunsire and Thomson (1988) and Dillman (1986) show that determined governments can decrease the size of bureaucracy in certain areas, but only at high political cost. Banks (1990) employs game theoretic analysis to show that agenda-setting bureaus can utilize their monopoly power to obtain budgets that are better than or equal to the "reversion level" (the budget that would be approved if the bureau's proposal were defeated). He shows that bureaus, utilizing informational advantages, can ensure growing or at least flat budgets. De Alessi (1969, 1974), Ahlbrandt (1973), Wagner and Weber (1975), Orzechowski (1977), Deacon (1979), and Bennett and Johnson (1979) apply data to Niskanen's original model and find overly large budgets and employment across government bureaus. De Alessi (1969) shows that the government tends to use lower discount rates than private firms, leading to overestimation of the benefits of investments, but exhibits no bias in cost estimates resulting in overinvestment in the public sector. Using data from metropolitan areas, Wagner and Weber (1975) find that the provision of public services is more appropriately classified as a monopoly, supporting Niskanen's proposition that bureaus act as the single supplier of their respective services. Deacon (1979) and Ahlbrandt (1973) identify large expenditure differences between purchasing and providing public services by local governments, which suggest bureaucratic overproduction.

Despite criticisms as to Niskanen's assumptions, a significant quantity of research subsequent to Niskanen (1975) has not overturned his basic conclusions. However, there have been relatively fewer studies on how performance, transparency and imperfect

information affect the results. This paper will attempt to shed more light on these questions.

2. The Behavioral Model

According to bureaucracy theory, a bureau's budget equals the total social benefit provided by its services, or as a function of the consumer preferences for the service, the quality of the service, and the quantity provided.

$$\text{Budget} = \text{Social Benefit} = f(a, b, Q) \tag{1.1}$$

Q = quantity of services performed

b = quality of performance (i.e., quality of the delivered service)

a = intrinsic value of the service

An implicit assumption of this model is that politicians could perfectly measure social benefit. Even if politicians could forecast the quantity of public service and consumer preferences for the public service, it is not plausible that politicians would be able to forecast perfectly the quality of the service. Following Tabellini and Alesina (1990), we build a behavioral model describing the interaction of a bureaucrat's choice to allocate energy to improving an agency's performance versus communicating (or obfuscating) information about the agency's performance, and a politician's decision to fund the agency in the presence of uncertainty as to the agency's actual performance.

Let the j^{th} agency have an actual performance, b^j, that will be realized at time $t + 1$. At time t, the i^{th} politician forms an expectation, $\hat{b}_i^j$, of the agency's performance. The difference between the expected and actual performances is a forecast error comprised of two components. The first component is a *natural variation* resulting from unforecastable

events affecting a bureau's performance. The second is an *idiosyncratic error* due to the politician's lack of information and/or inability to process available information correctly. We distinguish between the two error components because the politician should be held accountable for the second but not for the first.

Following the framework described in Davies and Lahiri (1995, 1999) and Davies (2006) for decomposing forecast errors, let $\hat{b}^j$ be the (unobserved) performance agency *j* would have achieved in the absence of any unforecastable events. Since the agency's actual performance is b^j, we have

$$b^j = \hat{b}^j + \varepsilon^j \tag{1.2}$$

where ε is the *natural variation* associated with agency *j*. Let the difference between politician *i*'s expectation of agency *j*'s performance, $\hat{b}_i^j$, and the performance agency *j* would have attained in the absence of unforecastable events be the *idiosyncratic observational error*, φ_i, such that

$$\hat{b}_i^j = \hat{b}^j + \varphi_i \tag{1.3}$$

This observational error is a combination of politician *i*'s imperfect information and individual bias. If all politicians perfectly processed all available information, the politicians would, by definition, have the same (and unbiased) expectation as to the agency's performance (i.e., $\varphi_i = 0 \ \forall \ i$). Davies and Lahiri (1995, 1999) and Davies (2006) show that even if forecasters (in this case, politicians estimating performances) perfectly processed all available information, because of unforcastable events, the expected performances may deviate from the actual performances.[1] The performance

[1] For more information on forecasting errors structure see Palm and Zellner (1991).

politician *i* expects the agency to attain is the agency's actual performance adjusted for politician *i*'s bias and for unforecastable events. Combining (1.2) and (1.3), we have

$$\hat{b}_i^j = b^j + \varphi_i - \varepsilon^j \tag{1.4}$$

Let Congress' aggregate perception of the performance of the j^{th} agency, $\bar{\hat{b}}^j$, be the average of *N* individual politicians' perceptions,

$$\bar{\hat{b}}^j = \frac{1}{N}\sum_{i=1}^{N} \hat{b}_i^j \tag{1.5}$$

Congress' perception of the agency's performance deviates from the agency's actual performance as (where there are *N* members of Congress and their individual expectations are weighted equally):

$$\bar{\hat{b}}^j = b^j + \frac{1}{N}\sum_{i=1}^{N}\left(\varphi_i - \varepsilon^j\right) = b^j + \gamma^j \tag{1.6}$$

where, from the Central Limit Theorem, $\gamma^j \sim N\left(0, \sigma^2_{\gamma^j}\right)$. Because Congress expects performance $\bar{\hat{b}}^j$, but knows the actual performance will deviate from the expectation, Congress faces a lottery wherein the expected outcome is $\bar{\hat{b}}^j$ and the expected payoff of the lottery is $f\left(a, b^j, Q\right)$ (Davies and Cline 2005, Varian 1992). Varian (1992) shows that a second order Taylor-expansion is adequate for approximating the expected payoff of a lottery. We have:

$$\begin{aligned} f\left(a,b^j,Q\right) &\approx f\left(a,b^j,Q\right)\Big|_{b^j=\bar{\hat{b}}^j} + \frac{1}{2} f^{(2)}_{b^j}\left(a,b^j,Q\right)\Big|_{b^j=\bar{\hat{b}}^j} \mathrm{E}\left(\bar{\hat{b}}^j - b^j\right)^2 \\ &\approx f\left(a,b^j,Q\right)\Big|_{b^j=\bar{\hat{b}}^j} + \frac{1}{2} f^{(2)}_{b^j}\left(a,b^j,Q\right)\Big|_{b^j=\bar{\hat{b}}^j} \mathrm{var}\left(\gamma^j\right) \end{aligned} \tag{1.7}$$

where $f^{(n)}_{b^j}$ is the n^{th} derivative of *f* with respect to b^j.

Let an agency be more *transparent* as the cost of constructing an accurate estimate of the agency's performance falls. More transparent agencies lend themselves to less costly analyses and so, ceteris paribus, we can expect politicians' expectations of the performances to be subject to less observational error. Letting T^j be the measure of agency *j*'s transparency, we have:

$$\frac{\partial \operatorname{var}\left(\gamma^j\right)}{\partial T^j} < 0 \tag{1.8}$$

A peculiar feature of agency performance reporting is the lack of established standardized performance measures. Individual agencies are permitted to choose their own performance metrics and, consequently, have the ability to report metrics that are, in fact, irrelevant. Let the *relevance* of agency *j*'s self-reported performance measure, r^j, reflect the degree to which that performance measure truly reflects the agency's performance. To recap, we have defined b^j to be agency *j*'s actual performance, and $\hat{b}_i^j$ to be politician *i*'s expectation of agency *j*'s performance. Now, let $\tilde{b}^j$ be agency *j*'s self-reported performance, and $\hat{r}_i^j$ be politician *i*'s perceived relevance of agency *j*'s self-reported performance. An individual politician's perception of relevance, $\hat{r}_i^j$, varies around the average relevance perceived by all politicians, $\overline{\hat{r}}^j$, by a random error τ_i, such that

$$\overline{\hat{r}}^j = \hat{r}_i^j + \tau_i^j \tag{1.9}$$

It is reasonable to suppose that, ceteris paribus, the better a politician's estimate of an agency's performance, the greater the relevance the politician will ascribe to the agency's self-reported performance measures (i.e., a politician's positive estimate of an

agency's performance will encourage a "halo effect" by which the politician will tend to perceive the agency's self-reported performance measures to have greater relevance). Conversely, the better an agency's *self-reported* performance, ceteris paribus, the less relevance the politician will ascribe to the agency's performance measures (i.e., ceteris paribus, a politician is more likely to suspect that an agency that self-reports excellent performance is attempting to make itself look better by reporting measures that are less relevant). Following this argument, let us assume a linear relation such that, for some positive constant *c*, we have:

$$\hat{r}_i^j = c\frac{\hat{b}_i^j}{\tilde{b}^j},\ c > 0 \tag{1.10}$$

and, in the aggregate:[2]

$$\bar{\hat{r}}^j = c\frac{\bar{\hat{b}}^j}{\tilde{b}^j},\ c > 0 \tag{1.11}$$

Solving (1.11) for $\bar{\hat{b}}^j$ and combining with (1.7) yields the expected social benefit of the agency:

$$f\left(a,b^j,Q\right) \approx f\left(a,b^j,Q\right)\Big|_{b^j=\frac{\tilde{b}^j\bar{\hat{r}}^j}{c}} + \frac{1}{2}f_{b^j}^{(2)}\left(a,b^j,Q\right)\Big|_{b^j=\frac{\tilde{b}^j\bar{\hat{r}}^j}{c}} \operatorname{var}\left(\gamma^j\right) \tag{1.12}$$

It is reasonable to assume that an increase in the agency's performance will eventually be followed by an increase the agency's budget.[3] Thus (assuming for simplicity that the effect of performance on budget is instantaneous):

$$f_{b^j}^{(1)} = \frac{\partial f\left(a,b^j,Q\right)}{\partial b^j} > 0 \tag{1.13}$$

[2] For ease of discussion, we assume that the performance measures are scaled such that performance, and therefore relevance, is strictly positive.

[3] This assumption if supported by the empirical results of Gilmour and Lewis (2006).

The relationship between the budget and the level of transparency is less intuitive. Derivating (1.12) with respect to T yields

$$\frac{\partial f\left(a,b^j,Q\right)}{\partial T^j} \approx \frac{1}{2} f_{b^j}^{(2)}\left(a,b^j,Q\right)\Big|_{b^j=\frac{\tilde{b}^j\tilde{r}^j}{c}} \frac{\partial \operatorname{var}\left(\gamma^j\right)}{\partial T^j} \tag{1.14}$$

From (1.8), the first-order derivative on the right hand side is negative. We claim that it is reasonable to model the second-order derivative as a third-order polynomial such that the sign of $f_{b^j}^{(2)}$ changes at some "benchmark" level of performance, b^*. For example, suppose that an agency accomplished 70% of its stated goals. Whether Congress judges this to constitute good performance or bad performance requires that Congress compares the performance with the benchmark. Assuming declining marginal returns, Congress is likely to regard a fixed change in performance as being less meaningful for agencies that are performing far above or far below the benchmark. That Congress would evaluate performance against a benchmark is consistent with Banks (1990), and Kouzmin, Loffler, Klages, and Korac-Kakabadse (1999).

Expected performance above the benchmark level adds to the positive image and (eventually) the budget of an agency, while expected performance under the benchmark hurts the agency's budget. From the agency's perspective, forecasted performance relative to the benchmark is an economic good, while forecasted underperformance is an economic bad. Consistent with economic theory, diminishing marginal returns apply in both cases, which suggests that the function has an inflection point at the benchmark level of performance. We assume that social benefit as a function of performance follows a sigmoid function as shown in Figure 1.

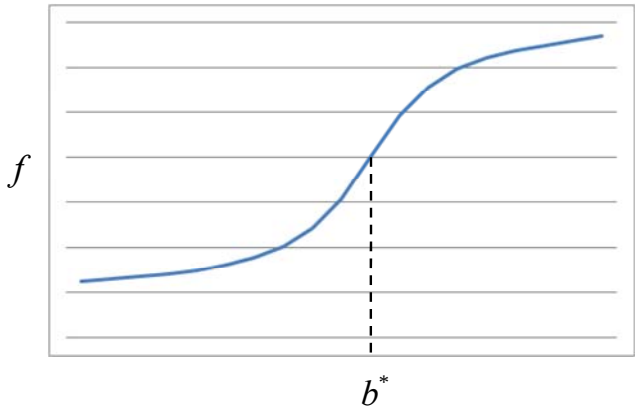

Figure 1. Relationship of Social Benefit to Agency Performance

This shape implies that

$$f_{b^j}^{(2)} < 0 \ \forall \ b^j > b^* \qquad f_{b^j}^{(2)} > 0 \ \forall \ b^j < b^* \tag{1.15}$$

and therefore, from (1.14),

$$f_{T^j}^{(1)} = \frac{\partial f\left(a, b^j, Q\right)}{\partial T^j} > 0 \ \forall \ b^j > b^* \qquad f_{T^j}^{(1)} = \frac{\partial f\left(a, b^j, Q\right)}{\partial T^j} < 0 \ \forall \ b^j < b^* \tag{1.16}$$

From (1.16) we see that agencies performing above the benchmark level prefer more transparency because increased transparency increases the payoff Congress expects from the agency. Similarly, agencies performing below the benchmark level prefer less transparency.

Suppose the bureaucrat can allocate a fixed quantity of effort either to altering an agency's performance or to altering the agency's transparency. Assuming fixed marginal costs to additional performance and additional effort the bureaucrat maximizes (1.12) subject to the constraint

$$\text{Fixed effort} = \alpha\left(\text{Performance effort}\right) + \beta\left(\text{Transparency effort}\right) \tag{1.17}$$

It is reasonable to assume that there is some "benchmark" level of transparency such that it is costly to increase transparency above the benchmark (i.e., the effort of reporting information is costly) but also costly to decrease transparency below the benchmark (i.e., the effort of hiding information is costly). Let us assume, for simplicity, that the benchmark level of transparency corresponds to the benchmark level of performance such that

$$\begin{aligned} \frac{\partial T^j}{\partial \text{ Transparency effort}} &> 0 \ \forall \ b^j > b^* \\ \frac{\partial T^j}{\partial \text{ Transparency effort}} &< 0 \ \forall \ b^j < b^* \end{aligned} \tag{1.18}$$

Because the first derivative of (1.7) is discontinuous at $\bar{\hat{b}}^j = b^*$, there are two optimization points: one for high performing agencies (i.e., $\bar{\hat{b}}^j > b^*$) and one for low performing agencies (i.e., $\bar{\hat{b}}^j < b^*$). The bureaucrat's first order conditions are:

$$\begin{aligned} \frac{f^{(1)}_{b^j}}{\alpha} &= \frac{f^{(1)}_T}{\beta} \ \forall \ b^j > b^* \\ \frac{f^{(1)}_{b^j}}{\alpha} &= \frac{f^{(1)}_T}{-\beta} \ \forall \ b^j < b^* \end{aligned} \tag{1.19}$$

where, due to (1.18), the first equation in (1.19) is the first order condition for agencies performing above the benchmark performance and the second is the first order condition for agencies performing below the benchmark performance.[4]

From (1.13) and (1.16), we have for high performing agencies:

$$\begin{aligned} f^{(1)}_{b^j} &> 0 \\ f^{(1)}_{T^j} &> 0 \end{aligned} \tag{1.20}$$

[4] For simplicity, we assume that high-performing agencies always perform above the benchmark while low-performing agencies always performer below the benchmark.

If the marginal cost of improving performance, α, increases relative to the marginal cost of increasing transparency, β, then the bureaucrat responds by substituting increased transparency for performance.

For low performing agencies, we have the opposite:

$$f_{b^j}^{(1)} > 0$$
$$f_{T^j}^{(1)} < 0 \qquad (1.21)$$

When the marginal cost of improving performance increases relative to the cost of decreasing transparency, the bureaucrat responds by substituting reduced transparency for performance.

Three conclusions result from our model: (1) from the agency's perspective, transparency is a substitute for performance; (2) *reduced* transparency is a good for agencies operating below the performance benchmark, while (3) *increased* transparency is a good for those operating above the benchmark. An important implication is that changes in oversight rules that affect the bureaucracy's marginal costs also affect the performance delivered by each agency.

3. The Data

In this section, we test the hypothesis that higher performing agencies prefer more transparency using data on discretionary budgets, reported performance, relevance, and transparency for twenty-two of the twenty-four largest federal agencies over the period 2002 through 2007.[5] Reported performances come from the Performance and

[5] The years were chosen based on the availability of reported performance data. The combined discretionary expenditures of the twenty-two agencies account for over 97% of non-military discretionary Federal Government spending for each year covered in this study. The two excluded agencies are the

Accountability Reports (PAR). According to the Government Performance and Results Act of 1993, each federal agency is required to submit annually a PAR along with its proposed budget. The PAR is a self-evaluation in which the agency classifies performance as "Not Met," "Met," or "Exceeded" for each of several self-identified goals. Agency specific discretionary budget data come from the annual publications of the Budget of the United States.

Transparency and relevance indices are constructed from data obtained from Scorecard, an annual publication of the Mercatus Center at George Mason University (for other studies using the Scorecard data set, see Parker (2003) and Chun and Rainey (2005)). Scorecard's purpose is to attempt to measure how well agencies disclose their performances – independent of the agencies' functions or their results. Scorecard provides three measures for transparency (each graded on a scale of 1 = inadequate to 5 = outstanding): *How easy is it to read/understand the PAR?*, *Is the cited performance data reliable, credible, and verifiable?*, and *Was there trend and baseline data included in the PAR for context?*[6] Our transparency index is the average of the three measures. Scorecard provides one measure for relevance (graded on a scale of 1 to 5): *Are the performance measures valid indicators of the agency's impact on its outcome goal?* This measure is our relevance index.

As control variables, we also include real GDP growth (which also serves as a proxy for the growth in Q) and political bias dummy variables. Previous literature suggests two ways of capturing the political bias effect. One is to separate agencies based

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Department of Defense (because transparency is a more complicated matter) and the Department of Labor (due to missing performance data).

[6] Scorecard has a fourth transparency criterion: *How easily is the PAR obtained?* As we are concerned with agency transparency as viewed by Congress, not the general public, and as Congress has ready access to all PARs, we exclude this criterion from our transparency index.

on historical liberal or conservative leanings (Gilmour and Lewis, 2006). Another is to define agencies as "in favor" if their budgets were growing faster than average up until a political power change. We use both measures. Definitions for the variables appearing in our model are shown in Table 1.

Table 1. Variable Definitions

Variable	Description
F_{jt}	Growth rate, from year *t*-1 to year *t*, of agency *j*'s real discretionary budget (nominal budget deflated by the Bureau of Economic Analysis' GDP deflator index). This is $f\left(a,b^j,Q\right)$ in (1.1).
B_{jt}	Agency *j*'s self-reported performance index in year *t*. This is $\tilde{b}^j$ at time *t*.
R_{jt}	Scorecard's relevance index for agency *j* in year *t*. This is $\bar{\tilde{r}}^j$ at time *t*.
T_{jt}	Scorecard's transparency index for agency *j* in year *t*. This is T^j at time *t*.
G_t	Growth rate of real GDP from year *t*-1 to year *t*.
L_{jt}	1 if Gilmour and Lewis (2006) identify agency *j* as a "Democratic leaning" agency in year *t*; 0 otherwise.
V_{jt}	1 if agency *j*'s budget grew faster than the average for all agencies from year *t*-1 to year *t*; 0 otherwise. This variable is a proxy for whether or not the agency is "in favor" politically at time *t*.

4. The Econometric Model

In this section, we apply the data to the theoretical model to test the hypothesis that transparency is desired by high performing agencies but not by the low performing ones. Combining (1.12) and (1.14) yields

$$f\left(a,b^j,Q\right) \approx f\left(a,b^j,Q\right)\Big|_{b^j=\frac{\tilde{b}^j\bar{\tilde{r}}^j}{c}} + \frac{f^{(1)}_{T^j}}{\dfrac{\partial \operatorname{var}\left(\gamma^j\right)}{\partial T^j}} \operatorname{var}\left(\gamma^j\right) \qquad (1.22)$$

The first term on the right hand side suggests that the agency's actual (and unobserved) performance, b^j, should be measured as $B_{jt}R_{jt}$. As a proxy measure for Q, we use the

growth in real GDP. We also assume that the intrinsic value of the agencies services, *a*, is constant over the data set. By (1.13), we expect the coefficient for $B_{jt}R_{jt}$ to be positive. From (1.16), we expect the coefficient for T_{jt} to change signs depending on whether the agency's performance is above or below its benchmark performance. This suggests the regressor $T_{jt}\left(B_{jt}R_{jt}-b^{*}\right)$ where the second term alters the sign of the coefficient associated with T_{jt}. Since $\text{var}\left(\gamma^{j}\right)$ is positive, by (1.8), $\frac{\partial \text{var}\left(\gamma^{j}\right)}{\partial T^{j}}$ is negative, and given (1.16), we expect the coefficient for $T_{jt}\left(B_{jt}R_{jt}-b^{*}\right)$ to be negative. This suggests the regression model

$$F_{jt}=\beta_0+\beta_1 G_t+\beta_2 B_{jt}R_{jt}+\beta_3 T_{jt}\left(B_{jt}R_{jt}-b^{*}\right)+u_{jt} \tag{1.23}$$

and the hypotheses

$$\begin{aligned} &H_0:\beta_2>0,\ H_A:\beta_2<0 \\ &H_0:\beta_3<0,\ H_A:\beta_3>0 \end{aligned} \tag{1.24}$$

We do not know the value for the benchmark performance, but assuming it to be positive, treating it as a parameter, and expanding the right hand side of (1.23) we have

$$F_{jt}=\beta_0+\beta_1 G_t+\beta_2 B_{jt}R_{jt}+\beta_3 T_{jt}B_{jt}R_{jt}+\beta_4 T_{jt}+u_{jt} \tag{1.25}$$

where $\beta_4=-\beta_3 b^{*}$. The corresponding hypotheses are

$$\begin{aligned} &H_0:\beta_2>0,\ H_A:\beta_2<0 \\ &H_0:\beta_3<0,\ H_A:\beta_3>0 \\ &H_0:\beta_4>0,\ H_A:\beta_4<0 \end{aligned} \tag{1.26}$$

We estimate (1.25) using feasible GLS and accounting for possible heteroskedasticity in the error term across agencies and time. Given the stochastic

component in (1.9), we use an instrumental variables procedure on R_{jt} with non-linear functions of B_{jt} as instruments. Our results appear in Table 1.

Table 2. Results

$$F_{jt} = \beta_0 + \beta_1 G_t + \beta_2 B_{jt} R_{jt} + \beta_3 T_{jt} B_{jt} R_{jt} + \beta_4 T_{jt} + u_{jt}$$

Regressor	Estimate	Standard Error	p-value
constant	-0.084	0.049	0.094
G_t	-0.032	0.008	0.000
$B_{jt}Rjt$	0.058	0.017	0.001
$T_{jt}B_{jt}R_{jt}$	-0.017	0.006	0.005
T_{jt}	0.053	0.022	0.016
R^2	0.23		
D.W.	1.79		

Feasible GLS, 22 agencies, 2003-2007, 81 observations.

When we include (separately) the political favor measures, L_{jt} and V_{jt}, we find their coefficient estimates to be insignificant and to have almost no effect on our results.[7]

5. Discussion

Our empirical results are consistent with the predictions of our theoretical model. Estimates of β_3 and β_4 imply that the (average) benchmark performance for the agencies, b^*, is 3.1. Of the twenty-two agencies, five performed at or above the benchmark at least once over the six years covered by the data set: Department of Agriculture (2004-2007), Department of Education (2007), Department of the Interior (2005-2006), Department of Justice (2005, 2007), Small Business Administration (2004), Department of State (2004-2007), Department of Transportation (2004-2007), US Agency for International Development (2007), and Department of Veteran Affairs (2006). Agencies that never performed above the estimated average benchmark over the six year period are: Department of Commerce, Department of Energy, Environmental Protection Agency, General Services Administration, Department of Health and Human Services,

[7] The coefficient estimates and standard errors for L_{jt} and V_{jt} are, respectively, -0.005 (0.006) and 0.008 (0.006). The weakness of these results is consistent with Gilmour and Lewis' (2006) findings.

Department of Homeland Security, Department of Housing and Urban Development, NASA, National Science Foundation, Nuclear Regulatory Commission, Office of Personnel Management, Social Security Administration, and Department of the Treasury.

We included real GDP growth as a proxy for the quantity of services performed by the agencies, *Q*. The negative coefficient associated with real GDP suggests that appropriated discretionary budgets decrease during economic expansions, which is in line with the principle of fiscal stabilization.[8] Lastly, it should be noted that the low R^2 is consistent with findings of previous researchers in which bureaucratic budgets have been seen to exhibit high levels of noise (Manchester and Norcross 2007, Gilmour and Lewis 2006).

6. Conclusion

The purpose of this research is to present a new theoretical model that describes the behaviors of politicians who, using imperfect information, judge an agency's performance, and bureaucrats who, by varying the agency's transparency, alter the degree of information imperfection and so influence the politicians' abilities to judge the agency's performance. Employing recent advances in rational expectation modeling to construct a behavioral model, we then fit transparency and performance data to our model and obtain empirical results that are consistent with what our theoretical model predicts. We conclude that an agency's transparency has a real effect on the size of its budget. According to our model, a high performing agency can increase its budget simply by increasing transparency – a lower cost, lower effort undertaking compared to increasing performance. The theoretical model also suggests that if increasing performance is not an

[8] As suggested by reviewers, we tested several different GDP lags. All come out significant and negative.

option (due to prohibitive marginal costs), bureaucrats would instead focus their efforts on altering transparency in order to increase their budgets. In the case of a lower-performing agency, this would take the form of the bureaucrat spending resources in an attempt to make the agency less transparent. The empirical results suggest that the theoretical model's sobering implication is not unfounded: that the political process rewards agencies not only for increased performance, but also for alterations in transparency. Because information imperfections (both unintentional and intentional) can obfuscate performance, agencies can end up being rewarded for actions that do not increase the social welfare.

The results suggest that changes in transparency can be taken as signals for performance. Assuming that the goal is to increase the size of an agency's budget, agencies that endeavor to increase transparency likely perform above the benchmark level while those that endeavor to decrease transparency likely perform below the benchmark level. Also, as the marginal cost of increased transparency falls relative to the marginal cost of increased performance (for example, due to the ability to post information on the Internet at low cost), the model suggests that agencies that perform above the benchmark will have greater incentive to spend resources on increasing transparency rather than increasing performance, while below-benchmark agencies will have greater incentive to spend resources on increasing performance.

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