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Task complexity, organizational size, and performance: an examination of the U.S. state budget agencies

Jia Chen[a], Yuan Yang[b] and Jinhai Yu[c]

[a]School of Public Economics and Administration, Shanghai University of Finance and Economics, Shanghai, China; [b]School of Economics and Management, Tongji University, Shanghai, China; [c]School of Public Policy, University of Connecticut, Hartford, CT, USA

ABSTRACT

We examine the impact of one dimension of administrative task configuration, task complexity, on organizational performance of government agencies. While task complexity allows greater specialization and thus positive returns to productivity, it often increases inter-task coordination costs. We argue that one can improve performance by designing heterogeneous tasks in small agencies and homogeneous tasks in large ones. We find empirical support for this proposition using panel data on 13 tasks of state budget agencies and fiscal management performance between 1986 and 2008. This study helps understand the performance impact of task complexity, a significant yet overlooked feature of agency structure.

KEYWORDS Task complexity; organizational performance; budget agencies

Introduction

Constantly facing complex and evolving governance challenges, governments frequently adopt administrative reforms to reorganize administrative tasks to improve their performance (Bach and Jann 2010; Kuhlmann and Bogumil 2021). One recent case of such reform initiatives surfaced in June 2018 in the U.S. federal government (United States Office of Management and Budget 2018). Bold changes were proposed to divisions and configurations of administrative tasks across and within multiple federal agencies, including departments in agriculture, commerce, education, labour, and beyond. While administrative reforms beget wide-ranging changes, one of their most direct aspects is the configuration of administrative tasks within government agencies. Administrative reforms often result in variation in the *complexity* of agency tasks, reflected by the heterogeneity and multitude in the tasks undertaken by an agency. However, recognized as one of the vital administrative characteristics shaping the effectiveness of public organizations (Moynihan et al. 2011; Jung and Eun Kim 2014; Choi and Moynihan 2019; Yu 2021), task complexity and its impact on agency performance have not been systematically examined in the public administration literature.

CONTACT Jinhai Yu jinhai.yu@uconn.edu

The authors made equal contributions to the research. Their names are alphabetically ordered.

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The assignment of tasks to organizational units has long been considered a crucial issue of organizational design (Rainey 2009, 214). Particularly, there is a tradeoff between specialization and coordination in organizational task design (Zhou 2011). As Rivkin and Siggelkow (2003, 292) point out, the central challenge is 'to divide the tasks of a firm into manageable, specialized jobs, yet coordinate the tasks so that the firm reaps the benefits of harmonious action'. The same challenge, if not a larger one, applies to organizational design in public organizations. Public organizations are often charged with multiple, heterogeneous tasks (Wilson 1989; Christensen and Lægreid 2006; Van Thiel and Yesilkagit 2014), resulting in substantial task complexity. Addressing the tension between task specialization and inter-task coordination (Zhou 2011) becomes pivotal to improving public organizational performance.

We examine the impact of task complexity on the performance of administrative agencies. While the organizational task design is by no means new, perhaps surprisingly, extant literature has been scattered on the relationship between task complexity and organizational performance. A classical proposition made by Gulick (1937), namely the 'principle of homogeneity', associates low task complexity with high organizational performance, though ensuing studies have questioned the proposition's validity (Simon 1946; Hammond 1990, 2007; Meier 2010). More recent public administration literature remains largely silent on this important issue. One exception is Andrews and Boyne (2014), who examine the impact of task complexity on administrative intensity in the case of U.K. universities. Yet, administrative intensity is more of a determinant than an indicator of organizational performance.

Synthesizing multiple theoretical perspectives, we propose that the impact of task complexity on organizational performance is conditional on organizational sizes. On the one hand, task complexity pools together multiple specialized tasks, which may improve organizational productivity through economies of scale (Buyl et al. 2011; Krause and Douglas 2013). On the other hand, it increases the costs of coordinating multiple tasks. Smaller agencies are better positioned to manage the coordination costs and thus harvest the benefits of task complexity. Larger agencies, by contrast, may see the benefits outweighed by the increased coordination costs. Therefore, task complexity should generate positive effects on organizational performance for smaller agencies and negative effects for larger ones.

We test this proposition in a panel data analysis of the U.S. state budget agencies from 1986 to 2008. State budget agencies provide a suitable case for studying task complexity because they perform various tasks, from revenue forecasting and contract approval to program evaluation. We measure the task complexity of the budget agencies with the Herfindahl index (HHI) that captures the heterogeneity of agency tasks across three functional areas of control, management, and planning. We measure budget agency performance with four indicators of state fiscal management performance: cash solvency, budgetary solvency, long-run solvency, and service solvency. The analysis shows that task complexity increases fiscal management performance in states with smaller budget agencies but decreases performance in states with larger budget agencies.

This study makes several contributions. First, we contribute to the literature on organizational task design by focusing on organizational size as a critical parameter that moderates the impact of task complexity on organizational performance. Second, we are among the first to examine the impact of task complexity on the performance of public organizations (Andrews 2009; Andrews and Boyne 2014). Given that the

majority of the literature has focused on private organizations and the public-private sectoral differences (e.g. Rainey and Bozeman 2000; Boyne 2002), a systematic investigation of public organizations is warranted. Third, while the specialization-coordination tradeoff harks back to the controversies surrounding the 'principle of homogeneity' (Gulick 1937; Simon 1946), we show that agency size is a critically important parameter to condition the impact of task complexity on organizational performance. Moreover, using data from NASBO surveys, we use a consistent operationalization of task complexity within U.S. state budget agencies over time and empirically assess the specialization-coordination tradeoff in agency task design in a large-sample empirical setting. Finally, tackling the question of how task complexity shapes administrative performance has critical policy relevance. By showing how agency size conditions the impact of task complexity on organizational performance, we provide direct evidence that could inform public organizational task designs and administrative reform initiatives.

Previous studies

Task complexity has been defined in various ways, as evidenced by multiple reviews of the construct and measurements (Wood 1986; Liu and Li 2012; Hærem, Pentland, and Miller 2015). According to Liu and Li (2012), there are three theoretical perspectives on task complexity, including those focusing on the structures of tasks, the resource requirements of tasks, and the interaction between tasks and task performers. From the structuralist perspective, task complexity is reflected by the structure of a task in terms of the number of task elements, the number of sub-tasks, and the variety or diversity of task elements, among others (Wood 1986; Ham, Park, and Jung 2011). We follow the structuralist perspective because it is most closely associated with the phenomenon of organizational task design, which is the key subject of this study.

Task complexity has three key dimensions: component, coordinative, and dynamic (Wood 1986; Hærem, Pentland, and Miller 2015). First, component complexity refers to the degree of distinctness in the acts executed and the information cues that must be used to yield the intended products of a task. Second, coordinate complexity is related to the interdependencies among acts, information cues, and products in task procession. Finally, dynamic complexity depicts the degree to which task performers adapt to the environmental changes that shape the relationship between task inputs (i.e. acts and information cues) and products. This study focuses on component complexity by defining task complexity as heterogeneity in the task components.

The extant research on private organizations has found that task complexity has mixed effects on organizational performance. On the one hand, task complexity improves organizational capabilities to tackle complex managerial problems and cope with situational and environmental changes (Nayyar 1993; Larsen, Manning, and Pedersen 2019). On the other hand, task complexity makes it costlier to process information, coordinate multiple tasks, and increase the risk of decision errors (Levinthal 1997; Ethiraj and Levinthal 2004; Rawley 2010; Zhou 2011). In the business and economics literature, a specific context of how task complexity affects firm performance comes from mergers and acquisitions. One challenge to a successful merger and acquisition comes from properly redesigning the task structures underpinning the integrated units in a new company bigger in size (Montmarquette et al. 2004). Materialization of synergy gains in revenue and efficiency is contingent on

successfully coordinating complex tasks within a larger company following the merger (Appelbaum et al. 2000; Han and Kleiner 2003; Chatterjee 2007).

While less attention has been paid to task complexity in public organizations, the concept itself could be traced back to the 'principle of homogeneity' proposed by Gulick (1937). Gulick's (1937) principle advocates for homogeneity in task assignments within agencies and captures a critical dimension of task complexity. His proposition has spurred lasting debates on organizational task design. Simon (1946) notably criticized Gulick's's (1937) doctrine as vague and internally contradictory. Other scholars have defended Gulick's's (1937) by pointing out his arguments are rich, subtle, or empirically oriented as opposed to merely 'administrative proverbs' in Simon's (1946) words (Hammond 1990; Meier 2010). Extant studies have applied the principle of homogeneity to analyse agency designs, often framed as the departmentalization problems (Boyle 1979; Hammond 1990). Few, however, have put this principle into empirical tests of its impact on the performance of government agencies.

Public administration scholars have recently started to examine the consequences of task complexity in public organizations. Noticeably, Andrews and Boyne (2014) find a U-shaped effect of task complexity on administrative intensity in U.K. universities. They operationalize task complexity as the size of 'occupational specialities' and the number of 'production sub-units'. Although administrative intensity is an important administrative outcome, their study does not directly investigate the impact of task complexity on organizational performance. Schinkel, Tóth, and Tuinstra (2020) propose a formal model of how agencies' discretionary budgets affect the priorities between complex tasks and simple tasks. They theorize complex tasks as those with uncertain outcomes or high expertise requirements.

Overall, the extant literature on task complexity has made remarkable advancements and opened several opportunities for further research. First, while task complexity is a vibrant concept central to the organizational design literature, it has received limited attention in public organizations. Second, the task complexity literature on private organizations has yet reached a consensus on the direction of its impact on organizational performance. Third, the few studies on the task complexity of public organizations are either normative (Gulick 1937) or focus on other outcomes than organizational performance (Andrews and Boyne 2014).

Why and when task complexity matters

Task complexity and task specialization

Theory suggests that organizations seek task specialization as a critical objective of organizational design. According to Dessein and Santos (2006, 962–963), task specialization is 'to partition the totality of tasks into smaller jobs and assign them to specific individuals or groups'. From this top-down perspective of task design, task specialization applies to an organization that performs multiple tasks. Furthermore, Tyler (1973) distinguishes task specialization from personal specialization. While personal specialization means specialized training of persons, task specialization refers to distributing official duties among multiple positions (Pugh et al. 1968).

As task specialization increases, the number, range, diversity, or skill requirements of the tasks would increase, leading to higher task complexity. Child (1973) observes that the level and range of specialization contribute to organizational complexity. In

a formal model of organizational task design, Bolton and Dewatripont (1994, 833) show that "the more specialized agents are, the larger and more complex is the communication network of coordinating agents' activities". This suggests that task specialization could lead to task complexity in terms of a larger number of specialized tasks or a given number of more specialized tasks.

It has been well documented that task specialization can generate positive returns to organizational productivity or performance. The general idea of productivity returns to specialization goes back to Adam Smith, who famously argues that 'the gains from specialization arise from the repetition of the same task, which improves dexterity, saves time otherwise lost in switching from one activity to another, and may lead to increased mechanization' (Bolton and Dewatripont 1994, 816). As Becker and Murphy (1992, 1157) point out, 'a more extensive division of labour raises productivity because returns to the time spent on tasks are usually greater to workers who concentrate on a narrower range of skills'.

To the extent that task complexity results from task specialization, it could increase organizational performance (Pondy 1969; Andrews, Beynon, and McDermott 2016). While task specialization serves as a major channel through which task complexity may increase organizational performance, it needs not to be the only one. Task specialization implies that an organization may perform better for a given number of tasks when they are more specialized. Holding task specialization constant, it is also possible that organizations would benefit from performing a larger number of tasks. This quantity dimension of task complexity can lead to better organizational performance through more intensive interactions among multiple tasks.

For one thing, task complexity may facilitate communication and innovation within organizations (Appelbaum, Marchionni, and Fernandez 2008). Task complexity often involves pooling together multiple types of information, skills, or expertise, enabling intensive interactions and higher productivity. These benefits are likely to increase in the number of tasks performed by an organization. Moreover, as Aiken and Hage (1971) argue, organizational complexity, in general, allows clusters of specialists to form the diversification of knowledge bases that stimulates innovation. Empirically, Zmud (1984) finds a positive impact of structural complexity on organizational innovation. This suggests that task complexity can improve organizational performance in the dimension of innovation.

For another, task complexity can expand the range of 'technologies' available for collective decision-making and thus improve organizational performance. A larger number of tasks may enhance the breadth of jobs in the organization (Cilliers 2000; Fonseca 2001). This widens the attention span of organizations and may allow them to adapt more robustly to task-specific shocks from organizational environments. A body of literature in strategic management also shows the 'economies of scope' in diversifying tasks within organizations (Rumelt 1974; Helfat and Eisenhardt 2004). The greater economies of scope in higher task complexity enhance organizational capabilities and performance (Zhou 2011; Larsen, Manning, and Pedersen 2019).

Task complexity and coordination cost

The benefits of task complexity for organizational performance come at the cost of coordination. The coordination costs resulting from task complexity hark back to early public administration scholars, especially Gulick's's (1937). Gulick's's (1937) believes

that assigning heterogeneous tasks to a single organization would create coordination problems. As he puts it, 'any organizational structure which brings together in a single unit work divisions which are non-homogeneous in work, in technology, or in purpose will encounter the danger of friction and inefficiency' (Gulick 1937, 10). Gulick thus advocates the 'principle of homogeneity' in organizational design because 'the efficiency of a group working together is directly related to the homogeneity of the work they are performing' (Gulick 1937, 9–10). Since task complexity implies lower homogeneity in tasks, the principle of homogeneity suggests that it should increase coordination costs and decrease organizational performance.

More recent literature suggests that task complexity may increase coordination costs in two ways. First, to the extent that task complexity results from task specialization, it has been widely noted that task specialization increases the demand for and the costs of coordination. As the existing scholarship on organizations and institutions suggests, organizations exist to tackle coordination problems in the process of specialization (Coase 1937; Garicano 2000). The coordination cost accompanying task specialization could reach such a high level that it ultimately limits the extent of specialization (Garicano 2000; Becker and Murphy 1992; Dessein and Santos 2006; Dessein et al. 2016). For instance, Becker and Murphy (1992) argue that specialization in firms is limited not only by the market, as observed by Adam Smith, but also by coordination costs. Similarly, Dessein and Santos (2006, 956–957) propose a formal model showing that 'the benefits of specialization are limited by the need to coordinate specialized activities'.

Second, task complexity can drive up coordination costs through the quantity dimension (Rushing 1967; Hall, Johnson, and Eugene Haas 1967; Mintzberg 1979). It would be costlier to coordinate a larger number of tasks even of the same specialization level (Gulati and Singh 1998; Rawley 2010). The ability of the leadership of an organization to effectively exercise its span of control decreases in the number of tasks performed within the organization (Hill and Hoskisson 1987). Furthermore, growth in the number of tasks increases the cost of information collection and processing that is critical to effective coordination (Tushman and Nadler 1978; Ethiraj and Levinthal 2004; Zhou 2011). As an organization incorporates a greater number of tasks, its performance will be 'increasingly constrained by the information processing requirements' (Tushman and Nadler 1978; Hill and Hoskisson 1987). The difficulty in precipitating such effective information processing is particularly salient when agents are assumed to be boundedly rational (Ethiraj and Levinthal 2004).

Task complexity and organizational size

The coordination costs of task complexity would attenuate its positive impact on organizational performance. Given the counteracting relationship between the productivity benefits and the coordination costs of task complexity, the question becomes under what conditions it increases or decreases organizational performance. Contingency theorists maintain that organizational structures must be adapted to key contingencies, such as organizational sizes to improve performance (Donaldson 2001; Rainey 2009, 215). In this case, as a critical dimension of organizational structure, task complexity may be adjusted to fit the contingency of organizational sizes.

The pivotal role of organizational sizes in moderating the relationship between specialization and coordination in organizational design has been observed at the team level (Becker and Murphy 1992), within organizations (Krause and Douglas

2013), and across organizations (March and Simon 1958). For instance, Becker and Murphy (1992, 1138) point out that 'modern work on principal-agent conflicts, free-riding, and the difficulties of communication implies that the costs of coordinating a group of complementary specialized workers grow as the number of specialists increases'. As organizational sizes increase, 'specialization increases until the higher productivity from a greater division of labour is just balanced by the greater costs of coordinating a larger number of more specialized workers' (Becker and Murphy 1992, 1157). In other words, the coordination costs may outweigh the specialization benefits as organizational sizes grow. To the degree that task complexity results from task specialization, it would be subject to the tradeoff between specialization and coordination.

The literature on firm mergers and firm performance suggests a similar case for public organizations. Like firm mergers, the restructuring of public organizations has been common in the various administrative reforms that reorganize tasks across government agencies (Grafton 1979; Bertelli and Andrew Sinclair 2018; Liang and Christensen 2019). A firm merger may increase the size of the company but simultaneously increase the information and coordination costs related to task complexity, which may make the costs of the merger higher than the gains (Appelbaum et al. 2000; Han and Kleiner 2003; Chatterjee 2007). In parallel, when public organizations restructure their tasks and increase the sizes at the same time, the efficiency gains of the task complexity may be outweighed by the increased coordination costs associated with a bigger agency size.

We argue that the same line of reasoning applies to task complexity, which is concerned about specialization and coordination among multiple tasks of an organization. The relative benefits and costs of task complexity on organizational performance are contingent on organizational sizes. As organizational sizes increase, the marginal coordination costs may exceed the marginal productivity benefits of task complexity, rendering a higher level of task complexity undesirable. Small organizations can harvest the benefits of task complexity before coordination becomes unmanageable, whereas large organizations need to refrain from task complexity to avoid increasing coordination costs. To improve organizational performance, one may design higher task complexity in smaller organizations and lower task complexity in larger organizations. Therefore, in the context of administrative agencies, we test the following hypothesis.

Hypothesis: *Task complexity within an administrative agency is positively associated with organizational performance when the agency size is small but is negatively associated with organizational performance when the agency size is large.*

Data and measurement

Task complexity of budget agencies

We use budget agencies of U.S. state governments as an empirical setting to test the impact of task complexity on organizational performance. Budget-making has been long recognized as a complicated process consisting of political, administrative, and technical dimensions (Wildavsky 1964). Schick (1966) proposes that budgeting has three primary functions, including management, control, and planning. Management refers to fiscal management, presumably a conventional function of budget agencies.

Control means internal control or internal management across state agencies for budget control. Planning refers to policy analysis and strategic management. This conceptual framework has received empirical support from surveys of budgeting practices of municipalities (Friedman 1975) and states (Daley 1985; Thurmaier and Willoughby 2014). Across the three functional areas, state budget agencies usually perform multiple tasks. In the light of the objective task structure defined in Wood (1986), these tasks require distinctive acts, information cues, or expertise, providing an ideal context to examine how task complexity influences organizational performance.

The data on state budget agencies are taken from the National Association of State Budget Officials (NASBO). NASBO conducted seven surveys of 'Budget Processes in the States' in 1987, 1989, 1992, 1997, 1999, 2002, and 2008. NASBO asked detailed questions about the tasks performed by state budget agencies.[1] We focus on the sample period between 1986 and 2008. Since the NASBO surveys are not annual, following Krause and Melusky (2012), we fill in the gap years with observations of the most recent surveys in previous or following years.

The NASBO data show that a state budget agency can perform as many as 13 tasks.[2] Table 1 shows summary statistics for the 13 tasks in three groups. First, six tasks are grouped in the category of management, including revenue estimating, accounting, fiscal note, tax expenditure, debt management, and cash management. The common feature of these tasks is that they all represent some aspects of 'managing the money'. Second, the category of control includes three tasks: management analysis, legislation review, and contract approval. They serve the main objectives of managerial and cost control. Third, the category of planning covers four tasks, including planning, program evaluation, economic analysis, and demographic analysis. These tasks share a policy focus and a long-term perspective.

Following the extant literature (Wood 1986; Ham, Park, and Jung 2011; Liu and Li 2012), we measure task complexity by the variety of task elements, or the 'diversity in terms of the number of distinguishable and dissimilar task components' (Liu and Li 2012, 564). Particularly, we focus on task complexity on the homogeneity-

Table 1. Descriptive statistics for tasks of state budget agencies.

VARIABLES	(1) N	(2) mean	(3) S.D.	(4) min	(5) max
Management (6)					
Revenue estimating	1,055	0.794	0.404	0	1
Accounting	1,037	0.372	0.484	0	1
Fiscal note	1,051	0.803	0.399	0	1
Tax expenditure	1,027	0.243	0.429	0	1
Debt management	1,031	0.342	0.475	0	1
Cash management	1,032	0.384	0.487	0	1
Control (3)					
Management analysis	1,055	0.905	0.293	0	1
Review legislation	1,050	0.966	0.182	0	1
Contract approval	1,018	0.427	0.495	0	1
Planning (4)					
Planning	1,046	0.733	0.442	0	1
Program evaluation	1,057	0.762	0.426	0	1
Economic analysis	1,050	0.650	0.477	0	1
Demographic analysis	1,018	0.361	0.480	0	1

Note: The sample covers 50 U.S. states between 1987 and 2008.

heterogeneity dimension. Drawing upon the theoretical framework by Schick (1966), we divide the tasks of state budget agencies into three groups of management, control, and planning. The assumption is that the tasks within each group, serving the same goal orientation, are more homogenous than those across groups. We then construct a Herfindahl index (HHI) to measure the degree to which the 13 tasks are heterogeneous across these three primary goals. HHI has been widely used to measure functional fragmentation of public organizations (Meier and Bohte 2003; Krause and Douglas 2013; Andrews, Beynon, and McDermott 2016; Hongtao and Cui 2019) and organization environmental complexity (Kotha and Nair 1995; Andrews 2009; Walker, Berry, and Avellaneda 2015).

The HHI index of task complexity is constructed as follows. First, we calculate the total number of tasks for each state budget agency in a year.[3] Second, we calculate the percent of tasks that fall into each group of management, control, and planning. Third, we square the proportions and add them up to obtain the HHI. By construction, a higher value of HHI indicates a higher level of homogeneity of tasks in any of the three groups. Given that HHI ranges from 0 to 1 by construction, to measure task complexity more intuitively, we subtract HHI from one so that a larger value indicates a higher level of task heterogeneity.[4] In other words, *task complexity* is measured with the formula (1-HHI). As shown in appendix 1, the task complexity of budget agencies as measured by the HHI index has substantial variation across states and over time between 1986 and 2008.

Measuring fiscal performance

Scholars have long noted that it is often demanding to obtain satisfactory performance measurements of administrative agencies (Van Thiel and Leeuw 2002; Chun and Rainey 2005). It is even more challenging to collect panel data to measure the organizational performance of state budget agencies. As a solution, we use the fiscal performance measurements of state governments as a proxy for the performance of state budget agencies. Budget agencies represent a pivotal player in contributing to and partly driving the state fiscal performance (Thurmaier and Willoughby 2001). The state fiscal performance is a joint outcome shaped by both state legislatures and governors as the political principals and budget agencies as the administrative agents (Wildavsky and Caiden 1988). We take a 'value-added' approach, that is, isolating the impact of state budget agencies on state fiscal performance by controlling for the variables that conventionally capture the impacts of state legislatures and governors. Adding the controls allows us to test the impact of budget agencies on the part of the state fiscal performance for which they are responsible. This approach is similar to the adjusted performance measurements that partial out the environmental factors out of managers' control (Stiefel et al. 1999) and the value-added approach to school performance measurements (Kim and Lalancette 2013).

More specifically, budget agencies can affect state fiscal performance in three ways. First, budget agencies provide technical expertise in managing state budgets that cannot be substituted by state legislatures or governors. This has a direct impact on state fiscal performance. For example, if a state budget agency performs well in managing the budget, everything else equal, the state is more likely to run a positive general fund balance or budget balance because the budget agencies may make revenue forecasts of higher quality, make better investment decisions in cash management or capital budgets, or simply make fewer mistakes in accounting. Second, budget agencies

may affect state fiscal performance indirectly by providing administrative support to governors. Budget agencies are the administrative arm that supervises almost all administrative agencies and can shape state fiscal performance by helping advance the governors' budget agenda (Thurmaier and Willoughby 2001). Third, budget agencies may affect state fiscal performance indirectly by influencing state legislatures (Smith and Jensen 2017). Budget agencies can interact with state legislatures frequently by attending hearings or defending governors' budget proposals (Thurmaier and Willoughby 2001). For example, Thurmaier and Willoughby (2001, p.44) note that 'governor and legislature rely on the state budget office and its examiners to serve as critical gatekeepers in the expenditure decision process'.

Scholars have used various measures of government fiscal performance. For instance, Wang, Dennis, and Yuan Sen (2007) measure state fiscal condition along four dimensions, including cash solvency, budgetary solvency, long-run solvency, and service-level solvency. There seems, however, no consensus on the best measures of fiscal performance. Recent studies have converged to use multiple measures (e.g. Jimenez 2019; McDonald, Decker, and Johnson 2021; Yu and Jennings, 2021). Following these studies, we construct four measures of fiscal performance.[5]

First, general fund balance is regarded as an indicator of cash solvency (Gorina, Maher, and Joffe 2018). It has been widely used to measure fiscal performance (Poterba 1994; Cummins 2013; Jimenez 2017). The variable *general fund balance* is calculated as total general fund balance as a percent of general fund expenditures. Second, total budget balance is often used as an indicator of budgetary solvency, or 'the ability of a government to generate revenues to meet its service and financial obligations in a fiscal year' (Jimenez 2019, 2). A rich literature in public finance has used budget balance to measure fiscal performance (e.g. Tujula and Wolswijk 2007; Lis and Nickel 2010). Specifically, *budget balance* is operationalized as budget balance per capita, calculated as total revenues minus total expenditures, scaled by state population. Third, debt outstanding per capita has been used as an indicator for long-run solvency (Gorina, Maher, and Joffe 2017), or 'a government's ability to pay existing long-term obligations' (Wang, Dennis, and Tu 2007, 14). A higher level of debt outstanding per capita indicates severer fiscal stress (Kloha, Weissert, and Kleine 2005) and lower long-run solvency. The variable *debt outstanding* is defined as total debt outstanding divided by state population. Fourth, total expenditure per capita indicates service-level solvency (Wang, Dennis, and Yuan Sen 2007) As Wang, Dennis, and Tu (2007, 9) put it, higher expenditures per capita 'indicate a more expensive government and lower service-level solvency'. The variable *total expenditure* is operationalized as total expenditures scaled by state population.

Model specification

The main goal of the empirical analysis is to pin down the associational relationships among task complexity, agency size, and organizational performance in the setting of state budget agencies. Since the sample is a panel of 50 states between 1986 and 2008, we estimate a two-way fixed effects model (Wooldridge 2010). The Augmented Dicky-Fuller test shows that the dependent variables are stationary, indicating that the level measures are suitable. We control for state and year fixed effects and heteroskedasticity-robust standard errors, as in Tujula and Wolswijk (2007) and Lis and Nickel (2010). In particular, the control of state fixed effects can partial out the unobserved,

time-invariant propensities of state legislatures to design budget agencies to achieve fiscal goals, which may help to reduce the likelihood of reverse causality. We include an interaction term between the two variables to test the conditional effects of task complexity by agency size. We specify the main model as follows.

$$Y_{i,t} = \beta_1 T_{i,t} + \beta_2 S_{i,t} + \beta_3 T_{i,t} S_{i,t} + \beta_4 X_{i,t} + \lambda_t + \gamma_i + \varepsilon_{i,t}$$

In this model, the dependent variable $Y_{i,t}$ is an indicator of state fiscal performance. $T_{i,t}$ is the HHI index of task complexity of state budget agencies. $S_{i,t}$ indicates the sizes of state budget agencies, as measured by the total number of employees in a budget agency. This variable is further transformed in the natural log form, *ln of agency size*, because agency size has a right-skewed sample distribution.[6] The next term shows the two-way interaction between the HHI index of task complexity, $T_{i,t}$ and ln of agency size, $S_{i,t}$. $X_{i,t}$ is a vector of control variables, λ_t is year fixed effects, capturing unmeasured factors influencing the fiscal performance of all state governments in a year, γ_i is state fixed effects that absorb time-invariant, unobserved factors within states over time, and $\varepsilon_{i,t}$ is the error term. In addition, a one-year lag of the fiscal variables and socioeconomic variable accounts for the time for state fiscal responses to such environmental factors.

For the control variables, $X_{i,t}$includes political, fiscal, institutional, and socioeconomic factors.[7] These variables are based on the literature on the politics of state fiscal policies (e.g. Alt and Lowry 2000; Lowry, Alt, and Ferree 1998; Krause and Melusky 2012; Yu and Jennings 2021). First, we control for two variables capturing fiscal preferences of citizens and policymakers, including *citizen liberalism* and *government liberalism*, and one variable of *party competition*. Second, we control for two fiscal variables, including *tax revenue growth*[8] and *federal aid growth*. Third, we control for one institutional variables,[9] *no deficit carryover*. Fourth, the model controls three state-level socioeconomic variables that could shape state fiscal performance, including *per capita income growth*, *population growth*, and *unemployment growth*.

All fiscal variables have been adjusted for inflation. Table A1 in appendix 2 summarizes the variables, measurements, and data sources. Table 2 reports the summary statistics. In the sample, one key independent variable, *task complexity*, has a mean of about 0.60 and a standard deviation of about 0.09, with a range from 0 to 0.667. The other key independent variable, *ln of agency size*, has a mean of about 4.40 and a standard deviation of about 1.27, ranging from 2.20 to 7.35.[10]

Results

Cash solvency and budgetary solvency

Table 3 shows results of the estimation where the dependent variables are general fund balance and budget balance.[11] The first two measures of state fiscal performance include cash solvency and budgetary solvency, respectively. For each dependent variable, the model is estimated with and without the interaction term between *task complexity* and *ln of agency size*. The model with the interaction term is used to test the conditional effects of task complexity by agency size.

Column (1) of Table 3 shows that *task complexity* has a positive and statistically significant effect ($p < 0.05$) on general fund balance. This suggests that the task

Table 2. Descriptive statistics for the variables.

VARIABLES	(1) N	(2) mean	(3) S.D.	(4) min	(5) max
Dependent variables					
General fund balance	1,060	0.087	0.132	−0.185	1.471
Budget balance	1,060	0.315	0.969	−5.084	8.483
Debt outstanding	1,060	2.720	1.919	0.175	15.15
Total expenditure	1,060	4.594	1.631	2.128	16.07
Key independent variables					
Task complexity	1,060	0.599	0.088	0	0.667
Ln of agency size	1,060	4.401	1.269	2.197	7.351
Control variables					
Citizen liberalism	1,060	50.82	15.22	8.450	95.97
Government liberalism	1,060	53.18	22.05	6.514	92.21
Party competition	1,060	0.877	0.094	0.611	1.000
Federal aid growth	1,060	2.981	10.06	−142.2	156.0
Tax revenue growth	1,060	−2.117	9.366	−57.21	43.71
No deficit carryover	1,060	0.576	0.494	0	1
Per capita income growth	1,060	1.967	2.261	−13.09	26.34
Population growth	1,060	0.011	0.012	−0.056	0.116
Unemployment growth	1,060	−0.004	0.147	−0.418	0.633

complexity of state budget agencies has a positive, unconditional effect on government fiscal performance. In the meantime, *ln of agency size* does not acquire statistical significance at the 0.10 level or above, suggesting the unconditional average effect of the size of state budget agency on general fund balance is insignificant. This implies the agency stocks of human resource alone is unlikely to shape general fund balance as an indicator of budget agency performance. Column (2) shows that *task complexity*, *ln of agency size*, and the interaction term reaches statistical significance at the $p < 0.01$ level. This indicates that the effect of task complexity depends on agency size.

To facilitate interpretation of the interactive effects, we graph the average marginal effect of task complexity on general fund balance by agency size in panel (a) of Figure 1. As agency size increases, the impact of task complexity on general fund balance decreases. When agency size is relatively small, task complexity has a positive and statistically significant effect ($p < 0.05$). When agency size is large, task complexity shows a negative and statistically significant effect ($p < 0.05$). This pattern of results is consistent with the hypothesis that task complexity increases state fiscal performance in small agencies and decreases it in large ones. We see statistically significant differences between the minimum and maximum values of agency size in panel (a) General Fund Balance, whereas the confidence intervals overlap over the whole range of agency size in panel (b) Budget Balance.

Columns (3) and (4) of Table 3 show the results for the dependent variable of budget balance. As shown in column (3), neither *task complexity* nor *ln of agency size* shows a statistically significant effect on the budget balance. The lack of unconditional effects implies that the benefits and costs of task complexity may offset each other. Turning to column (4), the interaction term between *task complexity* and *ln of agency size* shows a negative and statistically significant effect at the $p < 0.1$ level.

Again, the average marginal effects of task complexity by agency size are graphed in panel (b) of Figure 1. Overall, panel (b) shows a similar pattern of results as panel (a), which is not surprising since larger values of both general fund balance and budget

Table 3. Impact of task complexity on fiscal performance: Part 1.

VARIABLES	(1) General fund balance	(2) General fund balance	(3) Budget balance	(4) Budget balance
Key independent variables				
Task complexity	0.341**	1.338***	−0.434	0.596
	(0.163)	(0.311)	(0.298)	(0.617)
Ln of agency size	0.004	0.118***	−0.038	0.080
	(0.006)	(0.029)	(0.029)	(0.058)
Task complexity ×ln of agency size		−0.208***		−0.215*
		(0.048)		(0.125)
Control variables				
Citizen liberalism	−0.002***	−0.001**	0.001	0.001
	(0.001)	(0.001)	(0.008)	(0.008)
Government liberalism	0.000	0.000	−0.001	−0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Party competition	−0.042	−0.011	−0.231	−0.199
	(0.033)	(0.030)	(0.268)	(0.280)
Tax revenue growth	−0.001	−0.001	−0.021***	−0.020***
	(0.002)	(0.002)	(0.004)	(0.004)
Federal aid growth	0.001	0.001	−0.005	−0.005
	(0.000)	(0.000)	(0.003)	(0.003)
No deficit carryover	0.021	0.032	−0.229**	−0.218*
	(0.027)	(0.027)	(0.110)	(0.109)
Per capita income growth	0.003*	0.003*	0.011	0.011
	(0.002)	(0.002)	(0.011)	(0.011)
Unemployment growth	−0.074***	−0.075***	−0.143	−0.144
	(0.023)	(0.022)	(0.177)	(0.174)
Population growth	0.480	0.295	4.789	4.600
	(0.532)	(0.535)	(3.051)	(3.116)
Constant	−0.150	−0.780***	1.194**	0.573
	(0.104)	(0.199)	(0.550)	(0.692)
State fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,060	1,060	1,060	1,060
R-squared	0.690	0.718	0.587	0.588

Note Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

balance indicate better fiscal performance. Panel (b) shows that the impact of task complexity decreases in agency size. When agency size is small, task complexity shows a positive yet statistically insignificant effect ($p < 0.05$) on the budget balance. When agency size is relatively large, task complexity shows a negative and statistically significant effect ($p < 0.05$). This lends further support for the hypothesis that task complexity reduces performance in large agencies.

Long-Run solvency and service solvency

Table 4 shows the results of the estimation where the dependent variables are debt outstanding and total expenditure, the other two indicators of state fiscal performance that reflect long-run solvency and service solvency, respectively. Table 4 is structured the same as Table 3. Since larger values of debt outstanding and total expenditure indicate lower levels of long-run solvency and service solvency, we expect task

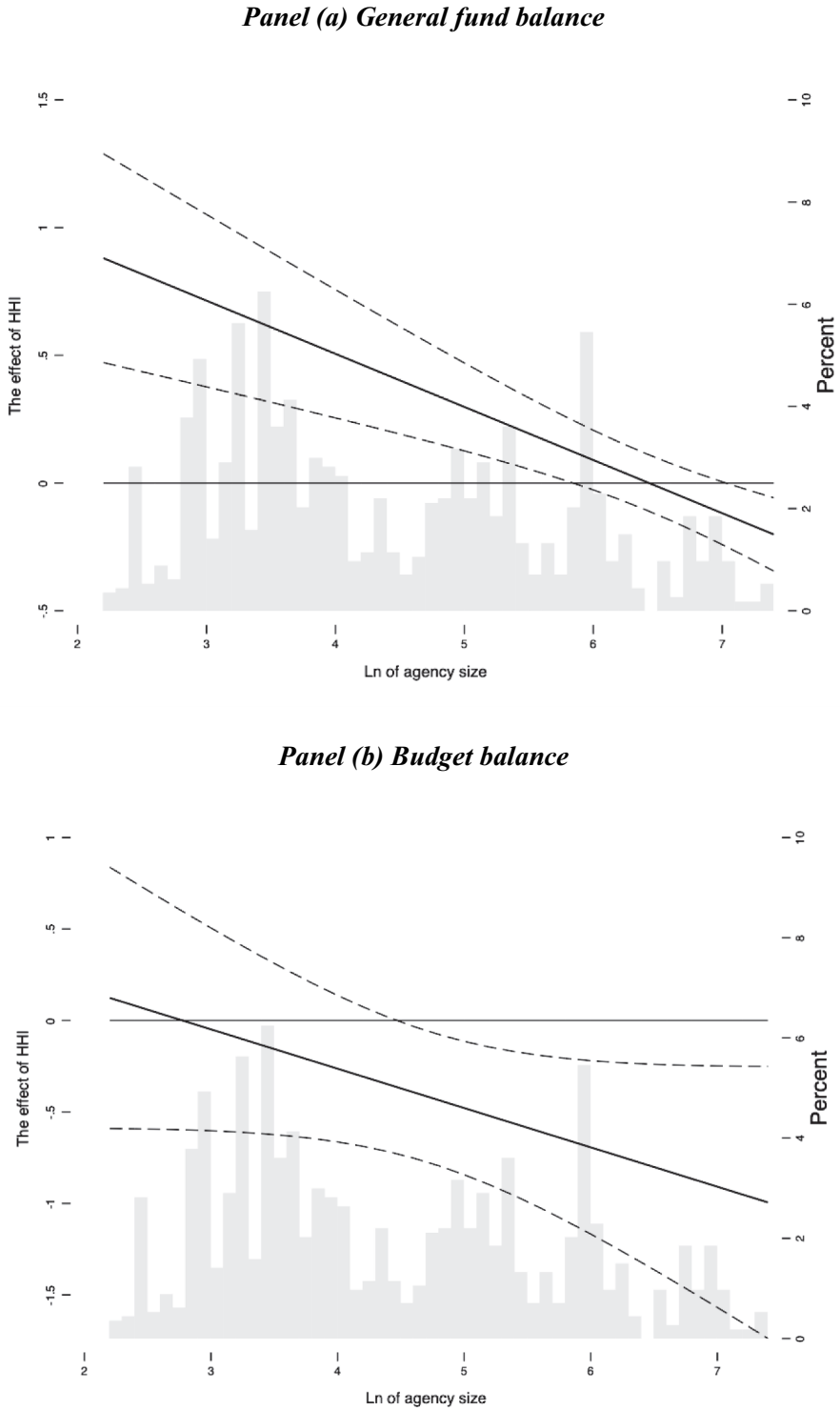

Figure 1. Marginal effects of task complexity on general fund balance and budget balance.

complexity to show opposite effects as compared to general fund balance and budget balance, where larger values show greater cash solvency and budgetary solvency.

Column (1) of Table 4 shows that *task complexity* has a negative and statistically significant effect ($p < 0.05$) on debt outstanding. This suggests that task complexity is positively associated with long-run solvency, a critical dimension of sound fiscal performance. Consistent with the results on general fund balance and budge balance, *ln of agency size* shows no statistical significance in its unconditional effect on debt outstanding. Column (2) of Table 4 shows that all the three variables of *task complexity*, *ln of agency size*, and the interaction term reach statistical significance at $p < 0.01$ level.

Figure 2 reports the average marginal effects of task complexity by agency size. We observe statistically significant differences between the minimum and maximum values of agency size in panel (a) Debt Outstanding and panel (b) Total Expenditure. As Panel (a) of Figure 2 shows, the impact of task complexity on debt outstanding is moderated by agency size. When agency size remains relatively small, task complexity shows a negative and statistically significant effect ($p < 0.05$). Task complexity shows a positive yet statistically insignificant effect when agency size is relatively large. Note that greater debt outstanding indicates lower fiscal performance. This is consistent

Table 4. Impact of task complexity on fiscal performance: Part 2.

VARIABLES	(1) Debt outstanding	(2) Debt outstanding	(3) Total expenditure	(4) Total expenditure
Key independent variables				
Task complexity	−2.868**	−10.185***	−0.406	−2.937***
	(1.263)	(2.722)	(0.293)	(0.495)
Ln of agency size	0.041	−0.795***	0.059***	−0.230***
	(0.043)	(0.245)	(0.023)	(0.057)
Task complexity ×ln of agency size		1.527***		0.528***
		(0.414)		(0.094)
Control variables				
Citizen liberalism	0.007*	0.004	−0.000	−0.001
	(0.004)	(0.004)	(0.003)	(0.003)
Government liberalism	0.003***	0.004***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Party competition	−1.039***	−1.266***	0.401***	0.323**
	(0.296)	(0.268)	(0.138)	(0.134)
Tax revenue growth	0.000	0.000	0.003	0.002
	(0.002)	(0.001)	(0.005)	(0.005)
Federal aid growth	−0.003	−0.003	0.003**	0.003**
	(0.003)	(0.002)	(0.001)	(0.001)
No deficit carryover	0.374***	0.298***	0.173*	0.146
	(0.102)	(0.106)	(0.101)	(0.101)
Per capita income growth	−0.047***	−0.045***	0.015	0.015
	(0.018)	(0.016)	(0.013)	(0.013)
Unemployment growth	−0.136	−0.131	0.027	0.029
	(0.199)	(0.193)	(0.121)	(0.119)
Population growth	−6.025*	−4.682	0.088	0.557
	(3.114)	(3.228)	(4.006)	(4.045)
Constant	2.653***	7.275***	1.835***	3.435***
	(0.759)	(1.685)	(0.248)	(0.358)
State fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1,060	1,060	1,060	1,060
R-squared	0.919	0.926	0.963	0.964

Note Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

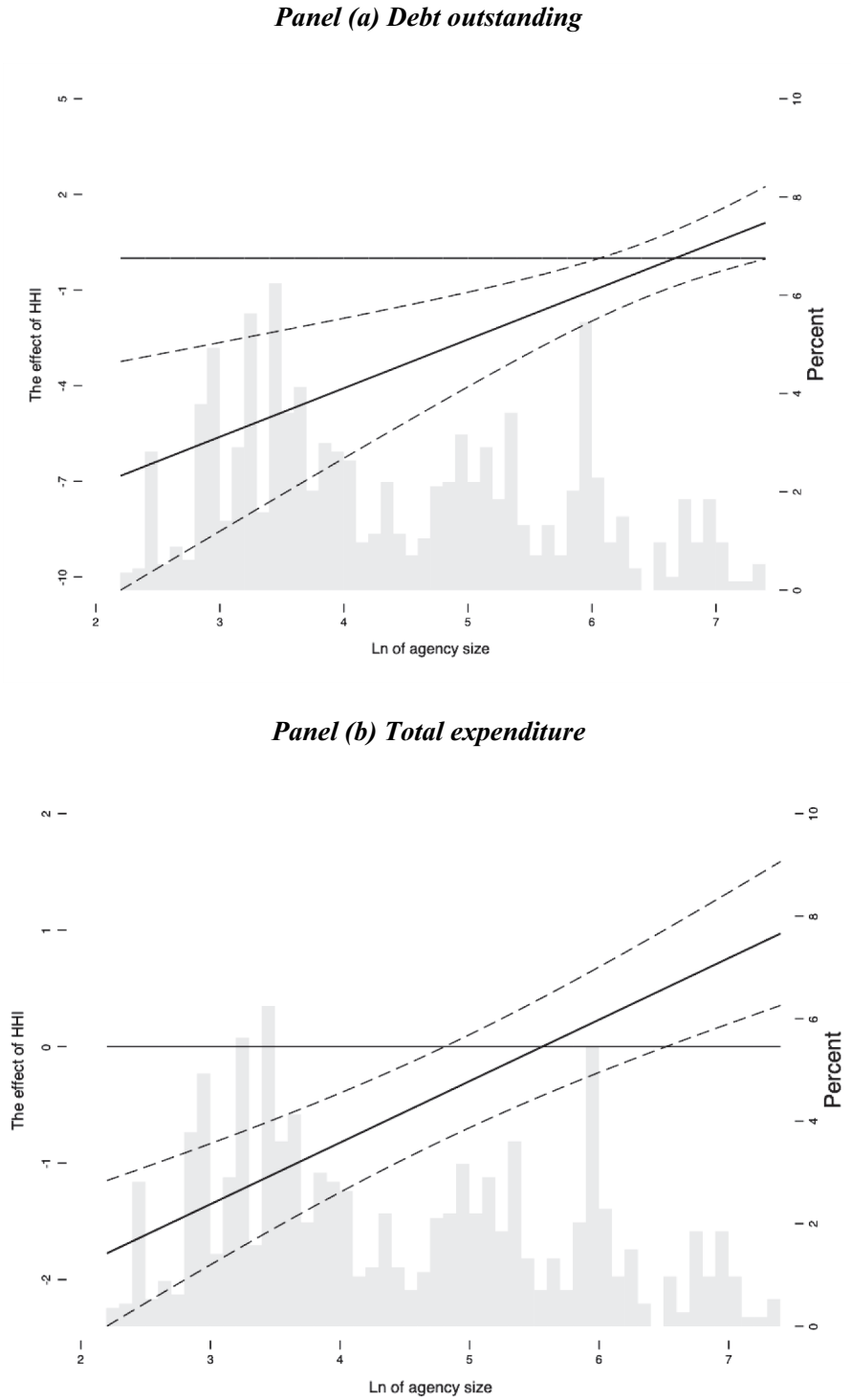

Figure 2. Marginal effects of task complexity on debt outstanding and total expenditure.

with the hypothesis that task complexity is positively correlated with performance when agency sizes are relatively small.

Columns (3) and (4) of Table 4 show the results for the dependent variable of total expenditure. Column (3) shows that *task complexity* has a negative yet statistically insignificant effect on total expenditure. Column (4) shows that *task complexity*, *ln of agency size*, and the interaction term reach statistical significance at $p < 0.01$ level. The significance of the unconditional effect of *ln of agency size* on total expenditure is in contrast with results on the other three indicators of agency performance. Panel (b) of Figure 2 presents the average marginal effects of task complexity by agency size. Panel (b) shows a similar pattern of results with that for the dependent variable of debt outstanding. For relatively small agencies, task complexity shows a negative and statistically significant effect ($p < 0.05$) on total expenditure. For large agency sizes, task complexity shows a positive and statistically significant effect ($p < 0.05$). In other words, task complexity decreases total expenditure for small agencies and increases it for large ones. Since larger sizes of total expenditure indicate a lower level of service solvency and weaker fiscal performance, this pattern of results supports the hypothesis that task complexity improves performance in small agencies and decreases it in large ones.

Robustness checks

We conduct four robustness checks for the main results. First, in the main model, we measure task complexity on the homogeneity-heterogeneity dimension by relating the tasks of state budget agencies to the three or four main goal orientations that they serve. We assume that the tasks within each group are more homogeneous than those across groups. This assumption seems plausible because the tasks differ qualitatively given that they support distinctive agency goals. An alternative to the measurement of task complexity is to make no assumption on such substantive grounds. The number of task elements has been widely used to measure task complexity in the literature (Wood 1986; Ham, Park, and Jung 2011; Liu and Li 2012). Thus, one may measure the task complexity of state budget agencies by the number of total tasks. Nevertheless, the cost of this approach is the loss of information on the qualitative differences among tasks. We re-estimate the main model with task complexity measured by the *number of tasks*. As reported in Table A2 and A3 of the appendix, the results remain materially unchanged.[12]

Second, we use budgetary delay as an alternative indicator of state fiscal performance. While all the four indicators of fiscal performance on cash solvency, budget solvency, long-term solvency, and service solvency tap the substance of state budgets, the budgetary delay can capture the procedural performance of state budgeting processes (Thurmaier and Willoughby 2001). Consistent with prior studies (Klarner, Phillips, and Muckler 2012; Andersen, Dreyer Lassen, and Holbøll Westh Nielsen 2012), we use two measurements of budgetary delay, including a dummy indicating whether a budget is late and a continuous variable indicating the days of budgetary delay. For both measurements, we find a consistent pattern of results with the main findings. That is, task complexity increases the likelihood and length of budgetary delay when the size of the budget agency is relatively large and decreases budgetary delay when the budget agency size is relatively small. We report the results in Tables A4 and A5 in the online appendix.

Third, to help address the endogeneity concerns, we have conducted a robustness check with an instrumental variable (IV) regression. We use the budget agency characteristics (i.e. task complexity and agency size) of 1975 and 1977 as the instruments for agency characteristics between 1986 and 2008. The key assumption is that the agency characteristics of 1975 and 1977 do not affect the fiscal management performance between 1986 and 2008 other than through affecting the subsequent agency characteristics. This assumption seems plausible because the agency characteristics are institutional designs that can be path-dependent. Because the instrumental variables have limited variation within states over time, we estimate a pooled, cross-sectional instrumental variable regression. In the IV estimation, we control for year fixed effects in addition to all the same time-variant control variables as in the main model. The results of the IV estimation show a similar pattern as the main findings. We present the IV results in the online appendix in Tables A6 and A7.

Fourth, to further address the concern on the omitted variable bias, we conduct a robustness check by including a more complete list of political control variables to account for the roles of state legislatures and governors in designing budget agencies to achieve their fiscal policy goals. Specifically, we control for three more variables on state legislatures and two more variables on governors to capture their preferences and institutional capacities to change budget agencies and fiscal management performance. For legislatures, we control for partisan control of state legislature, legislative professionalism, and legislative veto override majority. For governors, we control for governor's party and line-item veto authority. We find that the main results remain materially unchanged after adding these five control variables. We report the results in Table A8 and A9 of the online appendix.

Discussion and conclusion

While task complexity widely exists in public organizations, large or small, little attention has been paid to its impact on organizational performance. In the present study, we have examined how task complexity affects public organization performance. On the one hand, division of labour and task specialization improve organizational performance; on the other hand, increasing coordination costs emerge largely as a byproduct of the task specialization process. This tradeoff between specialization and coordination in shaping organizational productivity applies well to task complexity. Organizations with higher task complexity can improve performance because they pool together various skills, knowledge, expertise, or information, generating positive returns to specialization and enhancing between-task communication or organizational innovation. As organizations pick up more (potentially) complex tasks, nonetheless, the costs of coordination go up. Thus, balancing the productivity benefits and the coordination costs of task complexity becomes a constantly evolving process.

We further argue that organizational size plays a pivotal role in shaping the relative benefits and costs of task complexity. The starting point is that it is less costly to coordinate a given set of tasks in small organizations than large ones. We propose that task complexity is more likely to improve organizational performance in small organizations, where the coordination costs are manageable. Conversely, as organizational sizes drive up the coordination costs to a higher level, task complexity is likely to decrease performance, as the efficiency benefits could be outweighed. We find consistent empirical support in U.S. state budget agencies, with multiple indicators of state

fiscal management performance. The results are also robust across alternative measurements of task complexity, including the HHI index and the number of agency tasks.

This study provides evidence and implications for one of the classic propositions of public organizational design that remains insufficiently tested. Most importantly, we have provided the first empirical test for the 'principle of homogeneity' by Gulick's (1937). The present study suggests that organizations should follow the 'principle of homogeneity' when the coordination costs outweigh the efficiency gains from the pooling of different tasks. We partly confirm the insight of Gulick's (1937) that organizations can save coordination costs by performing more homogenous tasks. But we also show that there is an important condition for the principle of homogeneity to hold, that is, the presence of a large organizational size. While Gulick's (1937) notes the likely friction or conflicts that may result from heterogeneous tasks, he does not fully elaborate on the benefits of task complexity. We provide a task complexity thesis that extends Gulick's (1937) proposition with supportive evidence from the setting of U.S. state budget agencies.

In addition, this study speaks to the literature on budgetary decision-making by state budget agencies. Schick (1966) argues that budgeting reforms move from control to management and then to planning. Others argue that the three goals often coexist (Axelrod et al. 1973; Friedman 1975; Daley 1985). We assume that multiple orientations coexist in the same budget agencies and can be reflected in the various tasks. We then show that the task complexity as related to these goal orientations has a significant impact on budget agency performance. This study provides an empirical test of Schick's (1966) framework and helps understand the performance impact of budget agency characteristics (Thurmaier and Willoughby 2014; Yu and Jennings 2021).

The findings of this study have critical policy implications for organizational design and administrative reforms. We find that the impact of task complexity on organizational performance is contingent on the size of organizations. The findings suggest that policymakers may improve organizational performance by designing more complex tasks in relatively small organizations or less complex tasks in relatively large organizations. The various administrative reforms often entail the reorganization of agency tasks (Grafton 1979; Bertelli and Andrew Sinclair 2018; Liang and Christensen 2019). Policymakers may strike a balance between organizational size and task complexity when designing tasks within and across government agencies. Since too big organizations with too complex tasks do not perform well, policymakers may pay special attention to agency size as a constraint when the public sector reforms increase task complexity and agency sizes simultaneously. The search for optimal agency size to maximize the benefits of task complexity for organizational performance is most likely an evolving, trial-and-error process.

The present study is not free of limitations and thus opens several avenues for future research. First, our measurement of agency performance may be further improved. To measure budget agency performance, we have used five indicators of state fiscal performance, including cash solvency, budget solvency, service solvency, long-run solvency, and budgetary delay. One caveat to note is that state budget agencies are partly or responsible for what these indicators measure, and thus the measurements of state budget agency performance are indirect. While we have demonstrated a consistent pattern of effects of budget agencies, a more direct test of our hypothesis would be in order had direct performance measurements of state budget agencies be

available in future research. Besides, since the key research question of the present study is how the budget agency characteristics affect fiscal management performance, a complete investigation of the causes of the budget agency characteristics is beyond the scope of this study but a logical next step of the work.

Second, we measure task complexity with an HHI score capturing the degree of heterogeneity across the three functional groups of control, management, and planning of U.S. state budget agencies. We note that this measure is similar to Pugh et al. (1968), who measure specialization by constructing a list of 16 activities that they assume exist in all organizations in the sample. We make similar assumptions in our measure of task complexity. The 13 tasks exist in all budget agencies; if not, that means the task has yet been specialized as an independent one. If a budget agency has a task on the list, it means that some employees perform it. Since we focus on the objective, structural attributes of task complexity, we make no assumption about the distribution of specialists across tasks, which can be a subject for future study. One potential direction for future research is to test the impact of task complexity on organizational performance with alternative measurements that explore the multidimensionality of the concept. For instance, one can incorporate the importance of a task as an additional dimension to the number of tasks in the measurement of task complexity.

Third, although the model specification we adopted has, to some extent, alleviated concerns of endogeneity, the empirical results do not afford a strong causal interpretation. Our analysis is, nevertheless, a valuable first step towards it. The degree to which our main results can be interpreted as causal depends on how well the controls of state and year fixed effects and observable variables account for the unobservable and observable factors that affect the legislative design of budget agencies and fiscal management performance. These measures may alleviate, but not eliminate, the concerns about causal estimation, as is common in observational studies (Cook, Thomas Campbell, and Shadish 2002). Thus, the extent to which our results can be interpreted as causal estimates must be assessed with caution. Future research may provide a stronger causal test of the hypothesis by experimental or quasi-experimental research designs.

Finally, while we use budget agencies as the empirical setting, it is open to debate whether budget agencies have any unique features as compared to other administrative agencies. According to Gulick's (1937, 23), the budget agency is an example of 'process' agencies, where 'the basis of organization is the bringing together in a single office or department of all the workers who are using some particular kind of skill, knowledge, machinery, or profession'. This suggests that budget agencies may be more prone to task complexity. Gulick's (1937, 25) further points out that 'process departments must be coordinated not only to prevent conflict, but also to guarantee positive cooperation. They work hand in hand. They must also time their work so that it will fit together, a factor of less significance to purpose departments'. This implies that we have focused on an agency that is particularly concerned about intra-agency coordination across tasks, which may limit the extent to which it can accommodate task complexity for a given agency size. It remains an interesting expansion to compare the present findings to that of a 'purpose', 'client', or a 'place' agency (Gulick 1937) in future research.

Notes

1. We use the terms "task" and "function" interchangeably.
2. A few tasks, including pre-audit and data processing, are omitted due to a significant number of missing values in the NASBO survey data.
3. For the thirteen tasks shown in Table 1, we treat the few missing values as zero.
4. This results in a similar measure parallel to Blau's (1970) index that has been widely used to measure functional diversity.
5. See Table A1 in the appendix for more details on variable definitions and data sources.
6. The results, available upon requests, are robust without taking the natural log.
7. See appendix 3 for a detailed discussion of the control variables.
8. In the model of general fund balance, tax revenues are scaled by own-source general revenues.
9. The results are robust with controlling for alternative fiscal institutional variables such as balanced budget requirements or tax and expenditure limits.
10. To visualize the relationship between agency size and task complexity, we provide a scatter plot in Figure A2 of the appendix. In the scatter plot, we find a fairly even distribution of all possible combinations of agency size and task complexity in the data. We find high task complexity for both large and small agency sizes, and there seem to be no discernable associations between task complexity and agency size. Nonetheless, we do find less observations for the combination of relatively high task complexity and a very small agency size, indicating that there needs a critical mass of skilled employees to perform complex tasks.
11. For the thirteen tasks shown in Table 1, we treat the few missing values as zero.
12. As an additional check, we also adopt an alternative framework to categorize the tasks of state budget agencies by four groups of functions instead of three. Regression results based on this operationalization of task complexity are consistent with those in Tables 3 and 4. The results are available upon request.
13. Please either add a first footnote or an endnote to state that: The authors made equal contributions to the research. Their names are alphabetically ordered.

Disclosure statement[13]

No potential conflict of interest was reported by the author(s)

Notes on contributors

Jia Chen is an associate professor in the School of Public Economics and Administration at the Shanghai University of Finance and Economics. He received a Ph.D. from the Department of Political Science, the University of Colorado, Boulder. His research focuses on political economy and has been published in *Political Research Quarterly, Studies in Comparative and International Development, Canadian Journal of Political Science, Japanese Journal of Political Science*, and others. He can be reached at chen.jia@msg.shufe.edu.cn.

Yuan Yang is a lecturer in the Department of Business Administration in the School of Economics and Management at Tongji University in China. She received her Ph.D. in Consumer Behaviour from Purdue University, Indiana, USA. Her research focuses on consumer behaviour, international marketing, and business ethics. She has published in *Asian Business & Management*, *Journal of Business Ethics*, and *Problems of Post-Communism*. She can be reached at yuanyang@tongji.edu.cn.

Jinhai Yu is an assistant professor in the School of Public Policy, University of Connecticut. He received a Ph.D. from the Martin School of Public Policy and Administration, University of Kentucky. His research focuses on budgeting politics and debt policy. He has published in *Public Management Review, Public Administration Review, National Tax Journal, Public Performance and Management Review*, and others. He can be reached at jinhai.yu@uconn.edu.

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