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**OUTSOURCING EXPERT SERVICES BY STATE TRANSPORTATION
DEPARTMENTS: A LOOK AT EFFECTS ON COST, QUALITY AND CHANGING
EMPLOYMENT LEVELS**

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ABSTRACT

Privatization has increasingly become a policy option for government agencies struggling to meet rising demands for services but with fewer resources. In the transportation arena, many state departments of transportation (DOTs) have privatized by outsourcing highway functions to the private sector. But the outsourcing of technical and expert services such as those related to the design and construction of highway infrastructure may result in a smaller or less knowledgeable DOT workforce that is unable to perform the necessary contract management to ensure the quality of the work done by contractors. We posit an outsourcing process in which DOTs respond to the combination of increased demand for highway services and growing workforce constraints by contracting out much of the work formerly performed by in-house personnel. This, in turn, can produce perceptions of quality problems regarding the outsourced work and a subsequent expansion of the workforce. We examine the extent to which different highway-related tasks are being outsourced, the effect of workforce and employment factors on outsourcing, the perceptions of highway officials regarding the impact of outsourcing on cost effectiveness and service quality of the outsourced work, and subsequent employment levels.

INTRODUCTION

Over the past two decades, there has been a worldwide movement away from direct provision by public employees of government's traditional functions. Increasingly governments contract with private sector firms for the procurement of public goods and services (i.e. privatization). It should come as no surprise that privatization has become a popular option for government agencies struggling with dwindling resources with which to provide public goods and services to an expanding population. Outsourcing and various public-private partnerships are seen as viable solutions to the challenge of meeting service needs in the face of what Osborne and Hutchinson (2004) label a "permanent fiscal crisis." In the highway arena, which is the focus of this study, the turn to private sector contractors can be attributed to many factors, including state personnel shortages, the need for expertise, the pressure to reduce costs, and the potential for improved quality of service.

Contracting, however, poses risks to government agencies. The contracting relationship throughout American history has had more than its share of blemishes in the form of graft, corruption, shoddy work, and incompetence (Keeney, 2007; Durant, Girth, & Johnston, 2009). Thus, there is no a priori reason to assume that outsourcing will bring either lower costs or improved quality. Indeed, there is sufficient research to conclude that outsourcing does not automatically result in lower costs or improved quality in many situations (see for example Condrey & Battaglio, 2007; Hodge, 2000; Brudney, Fernandez, Ryu & Wright, 2005; Bowman & West, 2006). It may even increase costs and/or lower quality (Sclar, 2000; Bendick, 1989). In that the results of outsourcing can vary from beneficial to deleterious, research is needed to examine its effects across the various governmental functions to which it has been applied. This study examines the outsourcing of highway-related functions by state departments of transportation

(DOTs).¹ We specifically ask: what is the relationship between outsourcing and government employment in the context of highly technical and expert services such as the delivery of transportation infrastructure? We posit a dialectical sequence in which DOT's outsource functions, which may result in private sector employees replacing government employees and thus reducing government employment. This reduction is followed by a subsequent increase in employment, which we suggest is in response to perceptions of reduced quality associated with outsourced work.

Several studies have focused on privatization by state DOTs. However, most of the studies have been case studies of one or a few highway agencies (DeHart-Davis & Kingsley, 2005; Gen & Kingsley, 2007; Lee & Kingsley, 2009; Ponomariov & Kingsley, 2008). Our study employs the results of a survey sent to all state DOTs in the United States to explore the effects of outsourcing on the cost and quality of services. We examine the extent to which highway-related tasks are being outsourced, the perceptions of highway officials regarding the impact of outsourcing on cost effectiveness and service quality, and the relationships between outsourcing and employment in the state DOT.

In the next section, we review the research on state DOT contracting for services, followed by research on the effects of outsourcing on cost and quality. We then discuss the possible effects of outsourcing on the in-house capacity of DOTs to provide effective oversight. We draw five hypotheses from the research, describe the data, and present the analysis and findings. The conclusion presents implications for the practice and study of outsourcing.

RESEARCH ON CONTRACTING OUT FOR HIGHWAY SERVICES

DOT Contracting for Highway Services as a Response to Inadequate Staffing

¹ While our analysis involves state DOTs, our focus is on the highway functions of these DOTs. Specifically, we examine changes in employment levels related to highway functions.

Witheyford (1997) traced the history of outsourcing by state DOTs and documented the considerable increase in the amount of work outsourced to external consultants by the 1990s. Design activities were the first to be widely outsourced, followed by maintenance activities in the 1970s and administrative functions in the 1980s. This privatization trend continued into the 2000s. Ellis et al. (2000) found that 85% of state DOTs were using outside consultants to perform some of their construction engineering and inspection activities. A 2002 survey conducted by the Council of State Governments (CSG) found that highway and transportation functions are widely privatized, with 61% of responding state DOTs reporting that they had outsourced 15% or more of their work (Chi et al., 2004).

Ponomariov and Kingsley (2008) identified several conditions conducive for a state DOT to outsource. The first condition, the expansion of transportation facilities, points to the increased demand due to a growing volume of automobile and truck traffic. The other conditions involve workforce shortages, including (1) public finance rules that limit the ability to hire and use state employees on transportation projects; (2) previous downsizing of the workforce; (3) retirements by an aging workforce; and (4) changing civil service rules that make it possible for employees to retire early from the DOT and then work for private contractors. Witheyford (1999) and Warne (2003) observed that while federal legislations significantly increased the funds available to the states for highway programs, the states had static or reduced workforce levels with which to accomplish the work and were compelled to contract much of the work.

Calderon et al. (2000) conducted an in-depth analysis of DOT workforce issues and outsourcing. They observed that competition with private industry for professional engineers was driving many decisions to contract for various engineering services. Some states faced significant pay differences between the public and private sectors that caused additional

challenges for DOTs in hiring and retaining staff. To complicate matters, many states have been legally restrained from increasing the size of the work force, even when workloads have been rising (Rogge et al., 2003; Ponomariov & Kingsley, 2008). Gen and Kingsley (2007) argued that state DOTs have contracted out to “bridge the labor gap” created by the reduction in the number of transportation and highway personnel. Presumably, organizations outsource the work for which they are ill-suited or unprepared to perform (Durant et al, 2009).

The previous studies strongly suggest that highway outsourcing is as much a response to a shortage of qualified personnel to address growing demand for services as it is a reflection of a desire to economize on expenditures by reducing government personnel. One indicator of this would be greater outsourcing by the DOTs with smaller workforces or whose workforces have been shrinking in prior years. Another would be outsourcing when utilization of highway services goes up in a state, as indicated by an increase in VMT or lane miles. Coupling workforce with utilization of the transportation system, offers one measure of the state DOT’s capacity. Specifically, a high ratio would indicate the DOT has slack capacity to manage and maintain the state’s highway system. In contrast, a low ratio would suggest low capacity to address any additional pressure or demand placed on the system. Based on the literature on outsourcing of highway functions, we hypothesize that outsourcing is driven by the state DOT’s lack of capacity to meet additional demands placed on the highway system with its existing workforce. This lack of capacity can be measured both in terms of direct workforce measures (such as number of employees or growth in the number of employees) and the ratio of employees to vehicle miles travelled (VMT).

Hypothesis 1a: As state DOT workforce capacity (measured as the DOT employment numbers, payroll and growth in employment numbers and payroll) decreases, state DOTs outsource more highway functions.

Hypothesis 1b: As state DOT capacity (measured as the ratio of the highway-related workforce to VMT in the state highway system) decreases, state DOTs outsource more highway functions.

Of course, as suggested by the literature, outsourcing may also contribute to workforce reduction through loss of personnel as private sector workers replace government workers. This raises the possibility of simultaneity in that a reduction in personnel can be the motive for outsourcing even as outsourcing can be a response to a shortage of qualified personnel. However, we overcome this concern regarding simultaneity by explicitly incorporating the time element into the analysis. Specifically, we examine outsourcing as an outcome of employment factors from previous years. It is unlikely that the outsourcing decision in any given year will influence the number of DOT employees in prior years or the growth (decline) in employment levels in the DOT over those prior years.

The Impact of Outsourcing on Cost and Quality

Although most advocates of outsourcing argue that it reduces the cost of government, the empirical record suggests there are conditions under which it can in fact increase the cost of providing goods and services (Durant et al., 2009). Milward et al. (1993) contended that outsourcing can result in a “hollow state,” a condition likely to foster inadequate oversight of contractors. While Savas (2000) argued that competition in the bidding process is the key to reducing costs, there may not be a sufficient number of bidders to keep costs low (DeHoog, 1990; Brown & Potoski, 2004). A state DOT may come to rely on a limited number of

competitors, exposing it to the perils of small numbers bargaining (Williamson, 1975). In fact, DOT officials may even abandon bidding by turning to direct solicitation of the contractors they trust (Gen & Kingsley, 2007). Moreover, the process of creating, executing and managing contracts requires significant time, effort, and personnel, the cost of which may cancel out any savings generated from outsourcing. Wilmot et al. (1999) found that contract management raised costs 20% above the in-house level, with the difference being almost completely due to the additional costs from contract preparation and supervision of the contracted work.

It is no surprise then that the empirical record on the effects of outsourcing is mixed (Boyne, 1998; Brudney et al., 2005). Often the savings associated with outsourcing are either small (Chi et al., 2004; Hodge, 2000; Rehfuss, 1990), or non-existent (Duggan, 2004). Even within the same study, the findings can be mixed. For instance, Brudney et al. (2005) found that close to 25% of state agencies reported contracting out decreased the cost of delivering services, while 29% reported higher costs.

For transportation infrastructure and services, a CSG study (Chi et al., 2004) found that fewer than 5% of responding agencies reported cost savings of 10 percent or more. Ellis et al. (2000) observed that construction engineering costs when performed in house were 9% of total project costs but when performed by outside contractors were 12% of total project costs, and when DOT contract monitoring and administration costs were factored in, the outsourced work became 15% of the total project costs.

We found only one study that examined the impact of outsourcing on quality as well as cost (Brudney et al 2005). It found that respondents were more likely to view outsourcing as improving work quality (50% of respondents) than lowering costs (35% of respondents). Given the finding of previous studies on the minimal impact of outsourcing on cost savings and the

finding that outsourcing is more likely to improve quality than cost, coupled with the possible tendency to turn to contracting when in-house expertise is lacking (rather than to reduce costs), we hypothesize that state DOTs will be more likely to view outsourcing as improving the quality of service delivery than to lower the cost of providing services.

Hypothesis 2 State DOTs will perceive outsourcing to be more likely to improve quality than to lower costs.

The Subsequent Consequences of Outsourcing on Employment Levels

An undesirable loss of skilled employees with in-house production capabilities is a possible consequence of the outsourcing process. When an organization performs work in-house, its employees often develop deep knowledge and expertise in regard to each step of the production process (Durant et al., 2009). Outsourcing lacks this advantage and can reduce an organization's capacity to perform skilled work (Gen & Kingsley, 2007). Several years after outsourcing, an organization could find itself in need of in-house personnel with the requisite skills.

We could find no studies on the impact of outsourcing on the subsequent employment levels of DOTs. But Donahue (2002: 275) found that, in general, the effect of outsourcing on employment levels was slight, and concluded that “[f]ar from cutting to the heart of public employment, privatization seems to have been (at least so far) nibbling around its edges.” Greene (2002) observed a similar pattern among local governments. State DOTs may see reduced employment due to the actual outsourcing of work but given the emphasis on improved service quality over realizing cost savings, these state DOTs may also compensate by hiring additional staff or retaining existing staff for oversight and management tasks. Therefore, the greater the

extent to which the DOT outsources highway functions, the greater the need for contract management and oversight and the lower the likelihood that the DOT will see reductions in its workforce. Furthermore, the greater the expectation and perception of service quality problems, the more the state DOT will employ additional employees to ensure the desired level of quality. This also lowers the likelihood of workforce reductions due to outsourcing. In both situations, the state DOTs will likely see growth in its workforce due to the addition of staff for contract management and oversight. Therefore, in studying the effect of outsourcing on DOT employment levels, we hypothesize that:

Hypothesis 3a. State DOTs that outsource a greater percent of functions will add employees in subsequent years.

Hypothesis 3b. State DOTs that perceive reduced quality from outsourcing will add employees in subsequent years.

DATA AND METHODOLOGY

Our analysis involves two steps and spans the period from 1999 to 2007. In the first part of the analysis we focus on the percent of functions outsourced by the different state DOTs (in 2003) to determine if increased demand for highway services, employment levels and changes in employment levels over the prior three years are associated with the percent of highway functions that were outsourced. The second analysis examines the linkage between outsourcing in 2003 and changes in highway-related employment over the subsequent four years.

We rely on two sources of data. The first is a survey of the functions outsourced by state DOTs conducted in Fall 2003. The second is official statistics compiled by the U.S. Census Bureau (employment data) and the U.S. Department of Transportation (highway data). We also

collected political and economic data at the state level. Specifically, our dataset included citizen and state government ideology (Berry et al. 1998), population, population density, gross state product, and unemployment rates. These variables are intended to capture political and economic forces that may influence outsourcing and employment levels in state highway agencies. However, as will be discussed in the results section, these variables were not included in the final model. Table 1 summarizes the variables included in the analysis, their sources, and descriptive statistics.

 Insert Table 1 about here

Survey of Highway Functions Outsourced by State DOTs

The survey of functions outsourced by state departments of transportation (DOTs) used in our study was responded to by 30 states. We obtained permission to use the results of that survey from its senior author. In October 2003, the survey instrument was sent to the highest level official in the highway division of the state DOT. The surveys were filled out by that official or by their subordinates, such as state highway engineers or assistant state highway engineers.² The survey included a list of 16 highway functions and asked respondents to indicate if any of the work associated with each of the functions was outsourced. Note that respondents were not asked to estimate the percentage of the function that was outsourced, as it was unlikely that they

² These high-level state DOT officials are often the ones responsible for making key executive-level decisions about outsourcing. While it is possible that outsourcing decisions may be made at higher levels (for example, outsourcing may be required by statute for certain categories of projects or the DOT Director may make agency-wide decisions to outsource), the specific decisions about which projects to outsource and the evaluation of the service and cost impacts of outsourcing would be within the decision making realm of the DOT officials who responded to our survey.

would possess such knowledge across all functions.³ Highway functions in the survey covered all categories identified by Hancher and Werkmeister (2001). Despite the inability to specify the extent to which work is outsourced within the individual highway functions, our analysis captures the variety of function that are outsourced by state DOTs. Compared to other studies that do not specifically look across the many highway functions, our study examines outsourcing more broadly rather than focusing only on design or construction. Our focus is on the spread of outsourcing across the major functions of a highway agency, which we view as a measure of the extent of outsourcing. Some of the services included in the survey do not require technical expertise, but all entail an element of expertise in that the contractor must perform the expert task of organizing and supervising the work of both skilled and unskilled workers.

In addition to identifying the specific functions outsourced by each state, the survey asked for an evaluation of the perceived impact of outsourcing on the cost and service quality of the work outsourced. That is, was the outsourced work worse, the same, or better than when performed in-house by the state DOT? Respondents were asked to rate the impact of outsourcing each function on cost of service and quality of service on a Likert scale ranging from 1 to 5. A rating of one or two meant that outsourcing had a negative effect in terms of cost or quality; a three meant outsourcing produced no change in cost or quality; and a four or five indicated a positive change in cost or quality.

Because only 30 state DOTs responded to the survey, nonresponse bias was a concern in that those who responded may be more likely to outsource to a greater or lesser degree compared

³ The percentage of functions outsourced does not necessarily reflect the amount of work outsourced. A state DOT may outsource two different functions, but may only do so at 5% for one function and 95% for the other. Similarly, two state DOTs may outsource construction, but one may outsource 80% of its construction activities while the other may only outsource 10%. In this study, all instances of outsourcing are treated equally, regardless of differences across function within a state DOT or differences across state DOTs in a given function.

to those who did not. To check for bias, we compared survey respondents against non-respondents according to two other measures of privatization. The first is a measure of whether the state had, in recent years, sold or leased major transportation assets to private firms (ULI – The Urban Land Institute and Ernst & Young, 2007). The second is the percentage of transportation functions outsourced obtained from the 2002 CSG Survey (Chi et al. 2004). Using both measures, there are no statistically significant differences between survey respondents and non-respondents in terms of their privatization activities, suggesting that nonresponse bias is not an issue.

Transportation and Highway Data

Our analysis also relies on data from the U.S. Census Bureau and the U.S. Department of Transportation. The former included data from the Census of Governments, and specifically employment data for road and highway-related functions. This employment data included the number of full-time and part-time employees, the number of full-time equivalent employees, the number of hours worked by part-time employees, and payroll amounts. Data from the U.S. Department of Transportation were taken from the *Highway Statistics Series* (produced by the Federal Highway Administration), which contains data on characteristics of travel, the highway system in the state, and highway finance. Specific data collected from the *Highway Statistics Series* included data on state highway revenues, state expenditures for highway purposes, state capital outlays for highway purposes, vehicle-miles traveled in the state, and lane miles of the state highway system.

RESULTS

Extent of Outsourcing of Highway Functions and Perceptions of Effectiveness

Data from the survey of state DOTs indicate that most states outsource some part of a substantial number of highway functions. Table 3 summarizes the outsourcing of different highway functions. As observed earlier, the survey does not provide information about the extent to which each function was outsourced. Also, given that the survey was administered only in 2003, we are limited in our ability to measure the year-to-year fluidity and the multidirectional nature of highway outsourcing over time. However, while privatization practices in 2003 reflect prior decisions made with regard to outsourcing, it also reflects present year decisions to continue or discontinue contracting out with private sector firms.

 Insert Table 2 about here

In public policy, perceptions can be of equal importance to facts. The survey of state DOT outsourcing of functions asked the agency's staff to provide their *perceptions* of the cost effectiveness and service quality of the highway functions outsourced. Average responses for the different highway functions are presented in Table 2. The means on a 5-point scale (with 1 being most negative effect, 3 being no effect, and 5 being most positive effect) were 3.2 for cost and 3.8 for quality. Thus, respondents reported almost no cost savings from outsourcing, while perceiving small improvements in the quality of service. These results are supportive of Hypothesis 2, which predicted that perceptions of outsourcing's effect on quality would be higher than perceptions of its effect on cost effectiveness. That the perception of service quality are more positive compared to the perception of cost savings is statistically significant across all highway functions ($t=6.236, p<0.0001$). Furthermore, this difference between perceived quality

and perceived cost savings does not vary depending on the extent to which the state DOT outsources. Specifically, this difference is not correlated with the extent of outsourcing ($r = -0.1464$, $p = 0.4661$). Therefore, state DOTs that outsource more functions do not perceive such outsourcing to contribute more to quality than to cost savings, or vice versa.

The findings in Table 2 also show that highway departments are more likely to outsource some part of their core functions (e.g., planning, right of way, and design) than they are to outsource some part of their less central functions (e.g., traffic operations, equipment purchasing, and rest areas). Moreover, they do so despite indicating higher levels of quality and cost effectiveness from outsourcing the less central functions.

Employment Factors Driving State DOT Outsourcing

Our first regression model examines the extent to which the outsourcing of highway functions is associated with employment-related factors. Table 3 presents the results of this analysis. To arrive at this final model, we regressed the percent of highway functions outsourced in 2003 against four categories of independent variables. The first are employment-related variables, which we expect will have a negative relationship with outsourcing. This set of variables includes the number of full-time equivalent (FTE) employees per VMT in 1999, change in FTE employees per VMT between 1999 and 2002, change in hours worked by part-time employees between 1999 and 2002, and change in payroll as a percent of total highway expenses between 1999 and 2002. The second group of variables includes indicators of demand for highway services, such as population density in 1999, change in vehicle miles traveled (VMT) and change in lane miles between 1999 and 2002. Third, we have economic variables that control for resources available to and/or expended by the states and resources related to the

general economic environment in the state. The former includes change in highway revenues and change in highway capital outlays between 1999 and 2002. The latter includes gross state product and the unemployment rate. We have a fourth set of variables that are intended to represent the political environment surrounding outsourcing decisions in the state. These variables measure citizen ideology (Berry et al. 1998) and state government ideology (Berry et al. 2010) for 1999.⁴

 Insert Table 3 about here

Given the small sample size and concerns over degrees-of-freedom in the analysis, we first ran a full model with variables from all four categories as independent variables. In this full model, however, only employment-related variables were statistically significant. Therefore, a more parsimonious model was then fit, with the percent of functions outsourced being a function of capacity and employment factors in 1999 (the number of FTE employees per VMT) and changes in capacity and employment factors between 1999 and 2002 (change in FTE employees per VMT, change in hours worked by part-time employees, and change in payroll as a percent of total highway expenses). Overall, this reduced model was statistically significant ($F=3.31$, $p=0.026$). The regression results for this reduced model are summarized in Table 3. While the omission of the remaining three categories of independent variables may prompt concerns regarding an underspecified model and a negative effect on the explanatory power of the model, we believe the benefits of parsimony outweigh these concerns. Analysis of the correlations

⁴ Updated data for citizen and state government ideology were obtained from: Fording, R. State Citizen and Government Ideology. <http://www.bama.ua.edu/~rcfording/stateideology.html> [Accessed June 5, 2012].

between the variables dropped from the model and those included in the final model suggest that omitted variable bias is not a problem.

Regression results in Table 3 show support for Hypothesis 1, which predicts that state DOTs will outsource more functions as capacity, measured by the ratio of the highway-related workforce to state VMT, decreases. Other employment-related measures had the predicted negative relationship with the percent of highway functions outsourced and all were statistically significant. Change in the state DOT's capacity to address additional demands (measured as percent change in full time employment per VMT between 1999 and 2002) and change in payroll as a percent of total highway expenses between 1999 and 2002 were significant at the .01 level, while percent change in hours worked by part-time employees and number of FTE employees per VMT in 1999, were significant at the .05 level. Taken together, the results suggest that DOTs turn to outsourcing to meet rising use of (and demand placed on) the road and highway system when they lack capacity or are faced with a shortage of in-house personnel.

Subsequent Consequences of Outsourcing on the Number of DOT Employees

To determine the effect of outsourcing on subsequent employment levels, we regressed the change in employment levels (measured as the percent change in the number of full-time equivalent (FTE) employees) from 2004 to 2007 on the percent of functions outsourced in 2003, the perceived service quality and cost effectiveness of the outsourced work in 2003, and several control variables. We first ran a full model that included control variables to account for the initial size and capacity of the DOT workforce measured as the number of FTE employees and part-time employees as a percent of FTE employees (in 2004); several resource variables including highway revenues and highway capital outlays (in 2004) and the change between 2004

and 2007 in highway revenues and capital outlays; and demand variables such as change in lane miles and change in VMT between 2004 and 2007. Similar to the model for the extent of outsourcing, additional independent variables also included population density, gross state product, unemployment rate, citizen ideology, and state government ideology.

Following the full model, a reduced model was estimated that included percent of functions outsourced in 2003, service quality of outsourced work in 2003, cost effectiveness of outsourced work in 2003, in addition to control variables from the full model that were statistically significant at the $p < 0.10$ level (number of FTE employees per VMT in 2004, percent change in capital outlays from 2004 to 2007, and percent change in VMT between 2004 and 2007). This model represents the most parsimonious model that includes the three outsourcing variables hypothesized to be related to changes in state DOT employment and control variables that are statistically significant predictors of changes in employment. Due to concerns over omitted variable bias, the correlations between the variables omitted from the final model and those included in the final model were examined.⁵ The results of the final, reduced model are summarized in Table 4.

 Insert Table 4 about here

Results of the regression analysis show that as predictors of the change in highway-related FTE employment, the percent of functions outsourced was positive and marginally significant ($p < .10$) and the perceived service quality of outsourcing in 2003 (Hypothesis 3b) was negative and statistically significant ($P < .05$). This provides support for Hypotheses 3a and 3b.

⁵ With the exception of the correlation between GSP and cost effectiveness of outsourcing ($r = 0.389$, $p = 0.0449$), there were no other statistically significant correlations between omitted and included variables.

For every additional highway function outsourced by a state DOT (6.25% increase in percent of highway functions outsourced), the resulting impact on FTE employment is four-fold (27.7% additional growth in FTE employment). In contrast, a unit decrease in the perceived service quality of outsourcing, for example going from 3 (outsourcing has no effect) to 2 (outsourcing has negative effect), results in a 95% increase in FTE employment. As these results indicate, there is a strong relationship between subsequent employment and the extent of outsourcing and perceived service effectiveness of outsourcing. However, outsourcing cost effectiveness was not statistically significant as a predictor of growth in DOT employment.

The Overall Relationship between Outsourcing and DOT employment

In addition to the regression analyses, we also developed a path model that summarizes the relationship between employment and outsourcing variables over multiple years. This path model is presented in Figure 1. The path analysis shows that, in general, prior year employment factors – number of FTE employees per VMT in 1999, changes in the number of FTE employees per VMT between 1999 and 2002, changes in hours worked by part-time workers between 1999 and 2002, and payroll as a percent of total expenditures between 1999 and 2002 – negatively affect the extent to which highway functions are outsourced in 2003. States with smaller DOT workforces and smaller payroll relative to total DOT expenditures, coupled with lower growth in full-time and part-time employment will subsequently outsource more highway functions. In turn, this greater level of outsourcing and the perceived lower quality of the work outsourced contribute to greater growth in the state DOT workforce in subsequent years measured as the percent change in the number of FTE employees (between 2004 and 2007),.

Insert Figure 1 about here

CONCLUSIONS AND IMPLICATIONS

We have four primary findings from our analysis of outsourcing of highway functions by state DOTs. All have implications for our understanding of outsourcing and pose interesting questions for future research. First, most state DOTs are outsourcing a substantial number of different highway functions. Of these functions, those requiring specialized or technical skills, such as assessment and acquisition of right-of-way, surveying/photogrammetry, and geotechnical/materials testing, are outsourced more extensively (i.e. by more state DOTs). One of the contributions of this study is that, unlike other studies on outsourcing, we explicitly address the different highway functions that state DOTs may outsource. This allows for an examination of outsourcing across the different functions. However, our analysis focuses on DOT outsourcing at the aggregate level. Future research could focus more on analyzing outsourcing of these different functions. For example, researchers could examine whether if and how state DOTs are outsourcing core or central functions, or if they are focusing more on non-core functions and purchasing services that are more peripheral to their essential tasks.

Second, respondents from these state DOTs believe that outsourcing is more likely to improve quality than reduce costs. They reported almost no cost savings from outsourcing and small improvements in the quality of service, which supports our hypothesis that perceptions of outsourcing's effect on quality would be higher than perceptions of its effect on cost effectiveness. The respondents in the survey of DOT outsourcing reported an overall lack of perceived cost savings from their outsourcing, a finding similar to that of Brudney et al. (2005),

which may be an artifact of two related factors. First, our results imply that DOTs are probably more likely to outsource functions in areas where they lack sufficient expertise or lack a sufficient number of trained employees, and probably realize few cost savings when they have to pay the going rate for engineering skills, which tend to be costly. That cost savings are not associated with DOT employment levels might also be explained by the work of Ponomariov and Kingsley (2008) who found that the use of outsourcing, instead of being based on strategic decisions about potential cost reductions, has been spurred by incremental and reactive adaptations to internal and external events, such as a change in demand for services. It thus appears that a desire to save money may have very little to do with much of the turn to outsourcing by DOTs. Our finding that increased outsourcing led to higher employment levels in subsequent years is in line with research by Gransberg and Molenaar (2008), who in a survey of state DOTs found that a majority of the DOTs reported their professional workforce either remained the same or increased in size despite extensive outsourcing.

Third, lack of state DOT capacity to address additional pressure or demand placed on the highway system increases the extent of DOT outsourcing. Specifically, as state DOT capacity decreases, the DOT tends to outsource a greater number of highway functions.

Finally, the extent of outsourcing and the perception of lower service quality from outsourcing have a positive effect on the level of subsequent state DOT employment. Conversely, our analysis shows that state DOTs that perceive outsourcing as providing service quality comparable to or better than direct provision may perceive less need to expand the workforce to address possible accountability issues. Positive perceptions of outsourcing service quality may then contribute to the DOT being more receptive to additional outsourcing, further reducing the need for in-house expertise. Combined, these findings provide support for our

hypotheses and suggest that there is a relationship between outsourcing and employment within state DOTs that unfolds over time with opposite results.

One possible (and logical) explanation for this relationship is what can be labeled the accountability dilemma of outsourcing a complex task. This dilemma can be expressed in the form of the question: How does a public administrator know that a contractor is doing a complex task well when he or she lacks a sufficient number of employees (or employees with the right expertise) to assess the work plan, the cost estimates, and the overall quality of the work delivered by the contractor? While we believe that this kind of accountability dilemma could drive the subsequent increase in state DOT staff for management and oversight purposes, we do not have sufficient data in this study to test this. Future research may be able to tease out the role of the accountability dilemma, if any, in explaining the continued growth in state DOT employment after a turn to outsourcing.

Our findings suggest some additional implications for future research on the possible accountability dilemma associated with outsourcing government goods and services, particularly those that have high value-added or that involve significant technical expertise. However, our findings are tentative, as our measure of outsourcing does not include the percent of each function outsourced. And, of course, there are additional concerns motivating contracting out besides cost and quality. Moreover, these results may not be true of the less production oriented or technical-oriented government agencies (such as social services or corrections). Last, contracting out is a complex phenomenon that can have ramifications beyond those on the specific function in question, as savings in one area of an agency can impose costs on another.

We must acknowledge several key limitations of our study. First, given the small number of states that responded to the survey of state DOTs, we had a small sample to work with.

Furthermore, while we attempted to incorporate political variables into our model, concerns for parsimony and over degrees-of-freedom prompted the exclusion of these variables. As such, our research does not address the role of political factors that have been argued to influence transportation policy and administration. These factors play an important role in broader state-level policies regarding privatization, for example the decision to adopt privatization-enabling legislation. They may also influence agency-level decisions regarding privatizing government services or functions, although this connection is less clear. However, our analysis completely excludes political variables, so we are unable to address this linkage.

Another major limitation is the measurement of the extent of outsourcing. Clearly, future research will need to look at a more comprehensive measure of outsourcing or some substitute for it such as the percent of the state highway budget spent on contracts. This would allow a better estimate of the extent to which the state highway program is outsourced and the relationship to DOT employment levels. It would also be quite useful to extend the analysis to looking at the impact of outsourcing on highway performance indicators, particularly in light of questions about service quality of contracted work. The literature suggests that increased privatization should be accompanied by increased contract management and oversight. This might require not only additional employees, as suggested by our study, but also more specialized, highly-paid employees. The latter is not addressed in this study, but may be examined by looking at payroll trends. It is also of interest that maintenance, the function that employs the greatest number of highway department personnel, is less likely than many other functions to be outsourced. This requires further study, as some respondents may not have considered the more expensive and frequently outsourced forms of maintenance (e.g., one inch overlays) when responding to the survey.

On a final note, this study offers a unique dimension of outsourcing in that we incorporate concerns about service quality and cost effectiveness, which has been neglected not only by researchers in the transportation outsourcing arena but researchers in privatization and outsourcing more generally. We used subjective measures of perceived service quality and cost effectiveness of the outsourced work, which may be cause for concern for some. While objective measures may be better, such measures are not available and we argue that subjective perceptions remain important as they influence decision making within the state DOT to the same extent as objective measures. However, a greater concern would be that respondents may not know whether service quality or costs have improved or deteriorated following outsourcing. Specifically, they may not have a basis for making the comparison, for example, if they did not have exposure to the pre-contracting experience. Additionally, potential bias exists in the measure given that these respondents may also be involved in making the outsourcing decision, and may provide ex-post assessment that is consistent with or justifies the decision to outsource. Future research should examine how the subjective measures correlate with objective measures, to assess the extent to which subjective measures may be biased.

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Table 1. Variable Definition, Sources and Descriptive Statistics

Variable Name	Definition and Source	Year(s)	Mean	Std Dev	Min	Max
% highway functions outsourced	Percent of highway functions outsourced by the state DOT. Survey of Outsourcing Practices of State DOTs	2003	65.125	29.058	6.000	90.000
Service quality of outsourcing	Rating of outsourcing service quality compared to direct provision, averaged across outsourced highway functions (1=negative, 3=no change, 5=positive). Survey of Outsourcing Practices of State DOTs	2003	3.769	0.344	3.400	4.700
Cost effectiveness of outsourcing	Rating of outsourcing cost effectiveness compared to direct provision, averaged across outsourced highway functions (1=negative, 3=no change, 5=positive). Survey of Outsourcing Practices of State DOTs	2003	3.244	0.388	2.700	4.000
No. of FTE employees per VMT	Number of full-time equivalent employees, hours worked by part-time employees, and total payroll for highway functions. Government Employment and Payroll Statistics, U.S. Census Bureau (http://www.census.gov/govs/apes/) Vehicle-miles traveled in the state (in millions). <i>Highway Statistics Series</i>	1999	0.191	0.276	0.008	1.167
No. of FTE employees per VMT		2004	0.184	0.257	0.008	1.037
%Δ in FTE employees per VMT		1999-2002	65.481	278.294	-93.969	1455.562
%Δ hours worked by part-time employees		1999-2002	5.747	103.649	-100.00	520.378
Δ payroll as percent of total highway expenses		1999-2002	-9.087	30.149	-147.011	9.907
%Δ highway capital outlays	Percent changes in capital outlays for the state highway system. <i>Highway Statistics Series</i>	2004-2007	18.120	37.509	-40.922	114.169
%Δ VMT	Percent change in vehicle-miles traveled (VMT) in the state. <i>Highway Statistics Series</i>	2004-2007	2.498	3.305	-1.698	9.906

Note: All dollar amounts are nominal. Analysis using real dollar amounts (adjusted for inflation to 2007 dollars) did not produce significantly different results so the variables are included in nominal terms.

Table 2: Percent of States Outsourcing Function in 2003 and Average Effectiveness on Five Point Scale

Function	Percent of States Outsourcing	Average Effectiveness Rating on a 5-point Scale ^(a)	
		Quality of Service	Cost of Service
Right of Way	90%	3.4	2.9
Surveying/Photogrammetry	90%	3.6	3.1
Design	87%	3.6	2.7
Environmental Studies/Permits	87%	3.7	2.9
Geotechnical/Materials Testing	87%	3.5	3.0
Utilities/Railroad Coordination	87%	3.9	3.4
Planning	81%	3.6	3.1
Contract Procurement (Projects)	81%	3.7	3.1
Construction	74%	3.5	2.8
Construction Engineering (Oversight, Inspection, QA/Qc)	74%	3.6	3.4
Maintenance	71%	3.6	3.3
Traffic Operations	55%	3.8	3.3
Legal Services	32%	3.7	3.2
Program Management (Annual or Multi-year)	25%	4.4	3.7
Equipment Purchasing/Maintenance	15%	4.7	4.0
Rest Areas	6%	4.0	4.0
Mean	65%	3.8	3.2

(a) 1 = most negative effect, 3 = no effect, and 5 = most positive effect

Table 3. Results of regression model for percent of highway functions outsourced in 2003

	Coefficient	Standard Error	Standardized Coefficient
%Δ FTE employment per VMT, 1999 – 2002	-0.011**	0.004	-0.247
%Δ hours worked by part-time employees, 1999 – 2002	-0.032*	0.018	-0.212
Δ payroll as percent of total highway expenses, 1999 – 2002	-0.013**	0.004	-0.237
No. of FTE employees per VMT, 1999	-37.095*	20.593	-0.659
Constant	70.374***	3.601	
Adjusted R ²	0.127		
N	30		

*** p < .001

** p < .01

* p < .05

Table 4. Results of regression model for percent change in full-time equivalent employment, 2004-2007

	Coefficient	Standard Error	Standardized Coefficient
Percent of highway functions outsourced, 2003	4.426 ^{**}	2.879	0.238
Service quality of outsourcing, 2003	-95.404 [*]	47.631	-0.111
Cost effectiveness of outsourcing, 2003	-92.827	106.952	-0.184
No. of FTE employees per VMT(in thousands), 2004	-330.875 [*]	187.612	-0.290
%Δ in capital outlays, 2004-2007	1.388 ^{**}	0.555	0.177
%Δ in VMT, 2004-2007	8.075 [*]	4.301	0.091
Constant	356.925	230.365	
Adjusted R ²	0.456		
N	27		

*** p < .001

** p < .01

* p < .05

