The Many Faces of Span of Control: Organizational Structure Across Multiple Goals

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As an extension of the existing literature on span-of-control relationships, we propose that public bureaucracies are typically faced with multiple goals creating potential conflicts due to structural choices. In other words, optimal span of control for one goal may not be optimal for another. Findings from an analysis of nearly 600 public bureaucracies provide some evidence that structural changes designed to improve performance on one goal may hinder performance on others. The results from our analysis also demonstrate a functional form for the span-of-control relationship that is very different from the one suggested by recent theoretical work.

**Keywords:** span of control; organization theory; organizational performance; public management

Kenneth Meier and John Bohte have recently reinvigorated the seemingly moribund debate on span of control and the optimal manager-subordinate relationship. They offer a theory concerning the impacts and determinants of span of control and test it using data from educational organizations (Meier & Bohte, 2000; Bohte & Meier, 2001). The findings from these studies suggest that manager-subordinate ratios, along with other structural influences on production, deserve considerably more attention than they have received in modern research on administration.

In this replication and extension of Meier and Bohte’s work, we argue that public organizations have multiple goals and, therefore, face potential
conflicts when attempting to maximize one goal through manipulation of structure. We assess the potential for conflict with data from a sample of over 500 Texas school districts over a 4-year period.

SPAN OF CONTROL AND MULTIPLE GOALS

Meier and Bohte (2000) offer the first general theory on the functional form of the span of control-performance relationship for organizations. They hypothesize a quadratic relationship in which initial increases in span of control produce increases in organizational performance, though at a decreasing rate of return. By illustrating the potential nonlinear impacts of span of control, these authors make an important contribution to the discussion of structural influences on performance. Like earlier works, though, their analysis is incomplete because it considers the impact of structure on only a single organizational goal. The voluminous scholarship on public sector bureaucracy presents considerable evidence, however, that organizations are often asked to meet multiple goals (see reviews of this literature in Fottler, 1981; Meyer, 1982; see also Moe, 1989, 1990; Rainey, 1993, 1997). Thus, we suggest that attempts to maximize these goals may require different structural choices by bureaucracies and their political principals. In other words, there may be an optimal span of control for the production of one goal, but this may not be optimal for the production of another goal within the same organization.

Figure 1 illustrates the functional form as suggested by Meier and Bohte (2000). Increasing spans of control, according to the authors, allow for greater specialization, enhancing efficiency and performance. Eventually, however, large manager-employee ratios impede managers' ability to communicate, coordinate, and supervise. As ratios increase past a certain point, then, performance decreases at an increasing rate. This relationship also implies that the optimal level of span of control can be empirically estimated either by changing levels of span of control within a single organization and assessing the change in performance or by analyzing several similar organizations with different levels of span of control.

Not considered by Meier and Bohte (2000), though, is the fact that organizations also produce several different outcomes. These different outcomes may require different degrees of specialization or coordination, which in turn should lead to different optimal levels of span of control for these outcomes. Using the functional form suggested by Meier and Bohte, Figure 1 illustrates how maximizing one goal through the manipulation of
span of control can cause conflict by potentially decreasing performance on another goal when the relationship is nonlinear. Consider goal 1 to be a goal that requires relatively low levels of specialization and goal 2 to be a goal that requires higher levels of specialization. Increasing span of control up to 50 increases performance for both goals because they would both benefit from increased specialization. Increasing span of control after 50, the optimal level for goal 1, continues to increase performance on goal 2 but decreases performance for goal 1. The area between 50 and 75, then, is a zone of conflict where administrators of organizations must weigh the importance of each goal when attempting to maximize performance through structural changes. The two goals could share the optimal level of span of control, but if the effect of span of control on goals is conditional on the nature of the resources required to produce goals, then there will likely be a conflict.
DATA AND METHOD

To extend Meier and Bohte’s (2000, 2003; Bohte & Meier, 2001) work, we use their data set, which is composed of Texas school districts with enrollments of over 500 students, spanning the period from 1994 to 1997. Their research focused on the single goal of achievement on a basic academic assessment test, the Texas Assessment of Academic Skills (TAAS). Texas, though, requires schools to measure several performance indicators, TAAS pass rates, attendance rates, and dropout rates. These criteria are used in the Academic Excellence Indicator System (AEIS), which ranks school districts according to performance. An alternative measure of performance used in the AEIS is performance on college entrance exams. Student performance on college entrance exams represents a district’s ability to prepare students for a college education. To assess differing impacts on multiple organizational goals, we compare previous findings from analyses of TAAS scores with new models of alternative school district goals. Specifically, these include minimizing dropout rates and achievement on the Scholastic Aptitude Test (SAT).

Each model is estimated as a pooled time series. All models use an estimator that removes fixed effects and corrects for unit influence by year. The fixed-effects estimator alleviates problems of serial correlation and requires fewer assumptions about the error structure (Baltagi, 1995, pp. 11-12). Diagnostic tests indicated a small degree of heteroskedasticity across the panels, but the unequal error variance was not sufficient to bias standard errors. We use tobit regression for the analysis of the dropout measure because the measure is truncated, due to several districts reporting a dropout rate of zero (see Long, 1997).

DEPENDENT VARIABLES

The dependent variables in the analyses represent three organizational goals shared by school districts. The first is the measure employed by Meier and Bohte (2000)—the ability of a district to impart basic skills to students. As in their analyses, we measure it as the percentage of all students who pass the TAAS examination. Over the past decade, these tests have become one of the most important accountability measures for Texas school districts (Grogan, 2001; Popan, 2001).

The second goal in our analysis is the district’s ability to prepare students to successfully take college entrance exams. Numerous scholars suggest that, beyond basic skills, inspiring and preparing children to
attend college is also a high priority in many districts (Bracey, 1991; Hayes, Wolfer, & Wolf, 1996; Owen, 1999; Thomson, DeLeonibus, & National Association of Secondary School Principals, 1978). We measure success in this endeavor as the average score on the SAT in a district.

The final goal is decreasing dropout rates. Over the years, districts across the nation have seen decreases in dropout rates, but dropouts are still a significant problem in many areas. Dropout rates vary dramatically across districts and across different subgroups in the student population. Hispanic students, for instance, have a dropout rate that is nearly twice as high as that for White students (Feliciano, 2001). A recent study (Amrein & Berliner, 2002) also finds that high-stakes testing might increase dropout rates, suggesting an apparent goal conflict between the two goals. To create a performance measure where an increase in the value of the measure correlates with increased performance, we subtract the dropout measure that school districts are required to report from 100. As noted above, all three performance measures are part of the AEIS, thus they are measured in a comparable manner across Texas districts.

INDEPENDENT VARIABLES

We use the same set of independent variables used by Meier and Bohre (2000), including four measures of span of control. Meier and Bohre argue that school districts are multitiered organizations that encompass numerous managerial levels. To capture this multitiered nature, they develop four variables to measure span of control within school districts, which we in turn use in our analysis. The first measure of span of control is the ratio of school-level to district-level administrators. The second span-of-control measure is the ratio of teachers to school-level administrators across the district. The third indicator of span is the ratio of students to teachers. This is a measure of the ability of teachers to coordinate and run classes. The final span-of-control measure is average school size. This is a macrolevel indicator that has the previous three measures nested within it. Rather than measuring the ability to coordinate activity at any one level of the organization, school size measures the coordination within, among, and between the major production units within the district. Potential for goal conflict would be evident if at any point in the range of these four measures there is an opposite relationship for different outcomes. Referring back to Figure 1, conflict between goal 1 and goal 2 occurs between the values of 50 and 75 because the relationship between outcome and span of control is opposite between these points. To test for a nonlinear
relationship, squared terms for all the span-of-control measures were created and included in the regressions.4

In our analysis, we also control for additional influences on educational performance including the nature of organizational inputs (students) and available resources. The measures of student characteristics are the percentage of students who qualify for free or reduced lunch programs and the percentages of African Americans and of Hispanics enrolled in the district. The measures designed to capture resources include per-pupil instructional costs, teacher salaries, and teacher experience.5

FINDINGS

Table 1 presents the findings from our analysis of the impact of structural factors on the three different organizational goals. Focusing on the span-of-control variables, the model for TAAS performance shows that all four span-of-control indicators have a significant impact on TAAS pass rates. For both the SAT and dropout performance, three of the span-of-control measures are significant, with only the school- to district-level administrator measure failing to reach statistical significance for these models. Comparing the effects across goals allows us to assess the potential for conflict between goals.

For two of the span-of-control measures, the school- versus district-level administrator and student-teacher ratios, we find no evidence of goal conflict. First, the coefficients for the school- versus district-level managers are insignificant in the dropout and SAT performance models. We cannot, therefore, make a definitive statement concerning whether there is potential for conflict between these two goals and TAAS performance. Alternatively, student-teacher ratio has a significant, negative, linear effect on both TAAS and dropout performance.6 The relationship between the student-teacher ratio and SAT performance is negative and nonlinear. Moreover, this relationship is monotonic, meaning that it is predicted to be negative across the range of the measure. As with the school- versus district-level administrator measure, the results from this measure do not offer any evidence of a potential for conflict because decreasing class size would always increase performance, regardless of the performance measure.

The impact of the teacher-administrator ratio measure, on the other hand, shows potential for conflict across the three goals. This measure is
<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Texas Assessment of Academic Skills (TAAS) Performance</th>
<th>Absolute T-Score</th>
<th>Scholastic Aptitude Test (SAT) Performance</th>
<th>Absolute T-Score</th>
<th>Dropout Performance</th>
<th>Absolute T-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span-of-control measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School-district administrators</td>
<td>0.237</td>
<td>2.06</td>
<td>-0.125</td>
<td>0.12</td>
<td>0.028</td>
<td>1.58</td>
</tr>
<tr>
<td>Teacher-administrator</td>
<td>0.192</td>
<td>3.59</td>
<td>1.944</td>
<td>3.99</td>
<td>-0.134</td>
<td>3.29</td>
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<tr>
<td>Teacher-administrator squared</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.003</td>
<td>2.24</td>
</tr>
<tr>
<td>Student-teacher</td>
<td>-0.558</td>
<td>3.66</td>
<td>-28.109</td>
<td>2.32</td>
<td>-0.086</td>
<td>3.65</td>
</tr>
<tr>
<td>Student-teacher squared</td>
<td>—</td>
<td>—</td>
<td>0.735</td>
<td>1.82</td>
<td>—</td>
<td>—</td>
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<td>School size</td>
<td>-0.016</td>
<td>4.23</td>
<td>0.122</td>
<td>3.46</td>
<td>-0.001</td>
<td>2.26</td>
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<tr>
<td>School size squared</td>
<td>0.000001</td>
<td>3.72</td>
<td>-0.00007</td>
<td>2.25</td>
<td>0.0000008</td>
<td>1.68</td>
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<td>Control variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% low-income students</td>
<td>-0.278</td>
<td>18.24</td>
<td>-1.738</td>
<td>12.52</td>
<td>-0.018</td>
<td>7.63</td>
</tr>
<tr>
<td>% African American students</td>
<td>-0.239</td>
<td>16.34</td>
<td>-0.337</td>
<td>2.53</td>
<td>-0.004</td>
<td>1.90</td>
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<tr>
<td>% Hispanic students</td>
<td>-0.099</td>
<td>8.98</td>
<td>0.093</td>
<td>0.92</td>
<td>-0.002</td>
<td>1.40</td>
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<td>Teacher salary</td>
<td>0.001</td>
<td>5.62</td>
<td>0.000</td>
<td>0.14</td>
<td>0.000</td>
<td>1.65</td>
</tr>
<tr>
<td>Instructional expenditures</td>
<td>0.000</td>
<td>0.57</td>
<td>-0.008</td>
<td>1.59</td>
<td>0.000</td>
<td>2.55</td>
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<tr>
<td>Teacher experience</td>
<td>0.449</td>
<td>4.42</td>
<td>6.339</td>
<td>6.84</td>
<td>-0.051</td>
<td>3.25</td>
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<tr>
<td>Constant</td>
<td>59.805</td>
<td>19.05</td>
<td>1,074.721</td>
<td>11.53</td>
<td>102.170</td>
<td>180.33</td>
</tr>
</tbody>
</table>

Observations: 2,375
Adjusted $R^2$: 0.72
Pseudo $R^2$: 0.48
$F(15, 2359)$: 399.8
$LR \chi^2(15)$: 55.14

* a. Tobit regression is used for this model. The coefficients for tobit regression can be interpreted in the same manner as coefficients for ordinary least squares regression.
positive and linearly related to both TAAS and SAT performance. This relationship shows that there is no evidence for the potential for conflict between these two goals. In other words, increasing this measure across its range always produces increases in performance for both goals. However, the nonlinear relationship between the teacher-administrator measure and dropout rates, as indicated by the significant squared term, points to a potential for conflict. Figure 2 shows the relationship between this measure and the three goals. Increasing rates up to a 23.3 to 1 ratio of teachers to school-level administrators increases performance on the TAAS and SAT but decreases performance for the dropout goal. After that point, further increases produce increased performance in all three areas. This finding provides initial evidence that there may be an optimal span of control for the production of one goal, but this may not be optimal for the production of other goals within the same organization.

The coefficients for school size also indicate the potential for conflict. Figure 3 shows the conflicting nature of the relationship between this span...
of control and the three goals. For TAAS and dropout performance, the relationship is opposite from the one hypothesized by Meier and Bohte (2000), with initial increases in school size producing decreases in performance for these two goals. As the graph shows, there is potential for conflict until average school size reaches 665 students. Dropout performance still continues to decrease after this point, but decrease in performance is marginal. Alternatively, SAT performance improves with initial increases in school size. Increased values of the measure produce increases in performance up to 902 students, after which the trend reverses itself. Clearly, then, there is potential for goal conflict if administrators attempt to maximize one of these goals through the manipulation of structure. Attempts to maximize SAT scores through school size will produce a decrease in TAAS and dropout performance, at least until the average school size reaches 665 students. Again, this relationship highlights the difficulties
faced by public organizations that attempt to optimize multiple goals. Although a district might equally value all three goals, attempting to maximize one may negatively affect one or both of the other goals.

DISCUSSION AND CONCLUSION

We began this article with the proposition that different levels of specialization or coordination required to produce certain goals should lead to span of control having different impacts on different organizational goals, which in turn creates potential for goal conflict. That is, increasing performance on one goal through the manipulation of structure may lead to a decrease in performance on another goal. To test this, we analyzed the effect of four measures of span of control on three different outcomes in school districts. We found potential for conflict associated with two of these measures—teacher-administrator ratios and school size. If administrators or political principals had no control over span of control within their organization, then these findings would be meaningless. Administrators, though, can and do make choices regarding structure.

For instance, when deciding how to deal with growth in the student population, school and district administrators, as well as school boards and voters in bond elections, make choices between building new classrooms in existing schools or building new schools. Building new classrooms would increase school size, whereas building new schools would decrease school size. Our findings suggest building classrooms in existing schools might improve college entrance exam performance by increasing average school size but might decrease performance on the TAAS and dropout goals. Conversely, building new schools may be beneficial for TAAS and dropout performance but detrimental for SAT performance. To complicate matters further, the decision to build new schools or to build new classes affects teacher-administrator ratios. Building new schools would likely decrease the teacher-administrator variable, which could increase or decrease performance depending on the goal. These findings illustrate the importance of considering the multiple goals faced by public agencies when studying bureaucracy.

The findings from this analysis suggest that past conclusions about the optimal span of control for school districts or any other public bureaucracy have been somewhat misleading because public organizations and public managers pursue multiple goals. In the case used in this study, the
state of Texas requires districts to pursue multiple goals through the AEIS. Our analysis suggests that for these goals there are numerous optimal manager-subordinate ratios, perhaps one for every goal. The analysis presented herein cannot tell us conclusively why certain goals are more easily maximized with larger or smaller spans of control, though we speculate that the complexity of the task, and thus the importance of specialization and coordination, is an important variable. Nonetheless, the findings suggest that successful managers and organizations must search for structural arrangements that most closely approximate the optimal for the greatest number of goals. A fruitful next step for research on span of control might be to investigate such multioptimal structural choices and attempt to better understand the relationships among task complexity, specialization and coordination, span of control, and goal achievement.

Here we would like to offer a mild cautionary note concerning the findings and, in doing so, potentially further complicate the relationship between span of control and organizational performance. In this analysis, we have treated school districts as a single organizational type. Though defensible, this strategy does potentially ignore some subtypes of organizational form that may exist within the sample of districts. The specific characteristics of these subtypes may alter the impact of some span-of-control relationships in interesting ways, though we would not expect them to alter the core finding regarding the differential impacts of span of control across multiple organizational goals. Nonetheless, the potential existence of subtypes does provide yet another compelling justification for further research in this area.

The final conclusion that we draw from these findings centers on the specific character of each span-of-control relationship discussed above. We find that several span-of-control relationships are contrary to Meier and Bohle’s (2000) theory. A quick comparison of Figure 1 with Figures 2 and 3 reveals that their theoretical form is opposite of the empirical form in several cases. Meier and Bohle proposed that organizational performance would increase with larger spans of control, though at a decreasing rate, until a certain optimum, at which point performance would begin to decline. Our findings suggest, however, that initial increases in span of control lead to decreases in performance in certain situations, as shown with the relationship between school size and TAAS and dropout performance. Meier and Bohle advance the understanding of this organizational feature, but it appears that their theory still may not completely capture the complexity of the effect of span of control in organizations.
NOTES

1. To have a comparable sample across our difference measures of performance, we restrict their sample to districts with the Scholastic Aptitude Test performance measure. This diminishes the sample by 84 districts per year. We are still left with a sizeable sample, and the results of our analysis on Texas Assessment of Academic Skills performance are essentially the same as the results from the model presented by Meier and Bohte (2000). The main difference is that we do not find evidence of a nonlinear effect for the student-teacher measure. Even though we do not find a nonlinear relationship, the results from both analyses show that increasing class size will decrease performance across the range of class size in these data.

2. The dropout measure from the Texas Education Measure ranges from 0% to 9%. We transformed this measure by subtracting it from 100 and changing the range from 91 to 100, with 100 meaning perfect performance on this goal.

3. In both the school-district administrators and teacher-school administrators measures, administrators are the total number of administrators, not just the superintendent and principals. As a reviewer suggested, this is not the traditional concept of span of control where there is one manager to several subordinates. Principals, though, can utilize other administrators, such as vice principals, to help monitor subordinates. Assistant superintendents, along with other district-level staff, can serve the same role for superintendents in monitoring school-level administrations. These measures could be reconstructed to conform with traditional notions of span of control, but we choose to stay consistent with Meier and Bohte’s (2000) formulation of these measures for replication’s sake.

4. Squaring an independent variable and including it in an ordinary least squares regression estimates a quadratic relationship between the independent variable and dependent variable. If the squared variable is significant, then there is evidence of a nonlinear relationship. This technique can both predict a nonlinear, monotonic relationship or a nonmonotonic relationship where the effect changes signs depending on the value of the independent variable (such as the relationship that is shown in Figure 1).

5. For a more detailed description of the literature concerning these control variables, see Meier and Bohte (2000).

6. Meier and Bohte (2000) hypothesized that certain span-of-control relationships would be linear across the range across organizations. This would be evident if the squared term were not significant. Nonsignificant squared terms, then, were dropped from the model.

7. This is the same relationship found in Meier and Bohte (2000), although they misinterpreted the critical value for the first derivative as being a maxima when it was in fact a minima.

8. We thank an anonymous reviewer for this suggestion.

REFERENCES


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