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ABSTRACT—This research article examines how per-pupil spending on public primary and secondary education in Nebraska varies by school district size, and whether expenditures are expected to rise or fall after districts consolidate. We find a U-shaped relationship between per-pupil spending and the number of students per school district in Nebraska. We also find a similar relationship between property tax base and the number of students per school district. However, our analysis of per-pupil spending before and after consolidation fails to find consistent evidence that consolidation lowered per-pupil spending, in either rural or non-rural districts. The gains from consolidation become even more uncertain after considering the impact of consolidation on parent and student time costs, school quality, and community vitality.

Key Words: school district consolidation, education costs, government policy

INTRODUCTION

A standard business strategy to reduce costs and increase economic efficiency is to merge firms within the same industry or at different stages of production. A similar strategy has been adopted within primary and secondary public education in many states. For example, in the state of Nebraska the number of school districts has declined 66% over the past 20 years from more than 725 districts in 1992–93 to around 250 districts in 2011–12. It is argued that school district consolidation improves educational inputs, including facilities and labor (e.g., science and computer labs, science and math teachers), supplies and equipment via bulk purchases, and implementation of innovations in curriculum or management (Duncombe and Yinger 2007), at reduced costs.[1] Faced with declining populations, rural school districts are increasingly confronted with consolidation decisions as their local education funds dwindle and more reliance on nonlocal sources of funding occurs. This research article examines how the spending on public primary and secondary education in Nebraska varies by school district size, and whether expenditures are expected to rise or fall after districts consolidate.

Studies examining school consolidation have focused on the effect of consolidation on costs, academic outcomes, and local community vitality. In a review study, Howley et al. (2011) find that although there is some evidence of increased fiscal efficiencies from consolidation, the overall benefit to the state is minimal.[2] Moreover, consolidation has been found to be associated with reduced academic outcomes (such as lower graduation rates and lower achievement levels for impoverished students), and

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for the communities with the closing schools, an erosion of the communities' social and economic base, further fueling rural population decline and even community abandonment. Despite this evidence, state governments or other nonlocal bodies continue to encourage or even mandate consolidation (Blauwkamp et al. 2011). As a result local communities increasingly will be unable to weigh the costs and benefits of consolidation while taking into account community preferences for school location, school and class size, and the costs of providing public schools. Rather, they will be subject to governing entities that are more likely to be fixated on the monetary cost savings from consolidation and that are less likely to be attuned to potential educational benefits or community savings from smaller, localized schools and school districts.

Overall our results do not consistently indicate that consolidation leads to lower per-pupil spending. Rural districts in our sample experienced lower expenditures only if multiple consolidations occurred over time and they began only with the second consolidation. For rural districts with only one consolidation per-pupil spending was higher in the post-consolidation time period compared to the pre-consolidation time period, and for nonrural districts per-pupil spending was no different in the post- versus pre-consolidation time period.

ECONOMIC ISSUES

This section considers three fundamental economic issues related to primary and secondary education: (1) the investment in education, (2) paying for education, and (3) social costs and benefits from district and school consolidation. The goal is to identify some fundamental economic arguments surrounding education spending and to use them to help consider some of the potential economic consequences of school district consolidation. Although we do not provide an exhaustive list of economic issues related to education spending, we do try to identify the most important issues that relate to school consolidation.

INVESTMENT IN EDUCATION

Primary and secondary education is an investment of money and time to build human capital. The private benefits of investing in education include higher earnings potential, more intellectually rewarding job opportunities, and fewer spells of unemployment. However, many benefits of education spill over to society and include larger contributions to the economy's output, better citizenship (higher voting rates, more civic involvement), fewer crimes, and lower levels of substance abuse, among others. These spillover benefits of K–12 education provide motivation for public funding of primary and secondary education.

The time investment primarily comes from the students and parents, but also from volunteers in many settings, and involves time spent at school, at extracurricular activities, or at home studying on the part of students and fostering and aiding in studying on the part of parents. Parents and students also incur money and time costs to transport students back and forth between school and home. Transportation costs may be substantial, particularly for extremely densely or sparsely populated areas.

PAYING FOR EDUCATION

By tradition in the United States, primary and secondary education is supported by the public in the sense that parents have the option to send their children to publically provided schools. According to the U.S. Department of Education, 43.7% of education funds were provided by local governments, primarily through local property tax revenues, whereas 46.7% and 9.6% of funds were state and federal contributions, respectively. State and federal financial support of education may be warranted, given that as adults students may live anywhere in the state or nation. As a result, communities throughout the state or nation may gain from the spillover benefits of education to society, although many students will remain in their home communities.

The public provides funding for the monetary costs of education while students and their parents privately pay the time costs of schooling. This split of investment responsibilities may lead public officials to focus on the monetary costs of education relative to the time costs for students and parents. This may be especially true of state decision makers, given that local officials may be more attune to the tradeoffs between the time costs and monetary costs within their own communities.

Time costs also have important implications for local economic development. In particular, time costs can be substantially higher for parents who live in the rural countryside or in towns that do not have public schools. As a result, communities that are not served by public schools are at a substantial disadvantage at attracting and retaining families with children.

SOCIAL BENEFITS AND COSTS FROM DISTRICT AND SCHOOL CONSOLIDATION

These economic issues related to education inform our perspective of education policy, including decisions about school district consolidation. School district consolida-

tion has the potential to increase the returns to education if consolidation can both reduce cost and raise education quality, if any gains to quality outweigh any increase in cost, or if any reduction in costs outweighs the reduction in quality. But consolidation could reduce the returns to education if it fails to meet the above criteria.

District consolidation has the potential to reduce monetary costs by lowering the administrative costs for a district, as two administrations are merged into one. Even greater monetary costs savings are possible if school consolidation accompanies district consolidation—for example, if consolidated schools have higher pupil to teacher ratios. School consolidation, however, does not necessarily accompany school district consolidation.

An important issue that has not yet become commonplace when calculating cost savings from school consolidation is accounting for the additional time costs associated with the need to travel farther between home and school (Tao and Yuan 2005). Such costs should be included from the perspective of total social costs of education. The implication is that school consolidation that lowers the monetary costs of education may or may not lower the full social costs of education once travel time costs are included.

Moreover, when considering district school consolidation, an important question should be addressed: Is it necessary that residents of all school districts involved in a consolidation benefit from a higher return from education, or should it be the case that all districts together receive a higher return? The former criteria, if adopted, would set a higher threshold for conducting a successful consolidation.

Finally, as noted above, in the case of school consolidation, communities losing a school will face increased difficulty in retaining or attracting households with children, which will have substantial implications in terms of population loss and the long-term viability of these communities. This raises another important question: How much weight should this issue receive?

RELATED LITERATURE

Studies examining school consolidation focus on the effect of consolidation on costs, academic outcomes, and local community vitality. The discussion below reviews selected articles from these related strands of literature.

CONSOLIDATION AND COSTS

The research on economies of size in education is quite extensive and Fox (1981) and Andrews et al. (2002) provide in-depth reviews of the earlier literature. Overall evidence suggests that the quality and consistency of cost studies have improved and cost savings may exist by increasing district sizes from fewer than 500 students to 2,000–4,000 students, although diseconomies of size appear as enrollment reaches approximately 6,000 students (Andrews et al. 2002). A primary shortcoming of cost function studies is not accounting for the opportunity costs of increased travel time, which may be particularly important for rural districts. Tao and Yuan (2005) find that once commuting costs are accounted for, the average cost curve is reshaped from an L-shaped to a U-shaped curve, implying there is an optimal size rather than that districts should seek to be as large as possible.

Studies examining school *district* costs utilize a variety of methodologies, including cost functions and stochastic frontier models, and typically adjust for both differing student characteristics and education outcomes in each district (Duncombe and Yinger 2007; Jacques et al. 2000; Anderson and Kabir 2000; Ratcliffe et al. 1990). Moreover, they focus on the monetary costs of providing school services to the public sectors rather than time costs associated with education. Overall these studies find increasing economies of size as school district enrollment (or membership) rises, at least among smaller school districts. Jacques et al. (2000) examine school districts in Oklahoma during the 1994–95 period. They find economies of size exist in districts with an enrollment of up to 965 students but that standardized test scores dropped with further increases in enrollment.

Duncombe and Yinger (2007) examine cost savings from school consolidation utilizing data on rural New York school districts from 1985 to 1997. They differentiate between operating costs and additional capital costs associated with district consolidation and find significant operating cost savings per pupil from district consolidation. However, they also find significant increases in capital costs in consolidating districts partly due to the need to build new schools to serve the consolidated district and the state's aid program which provides subsidies to support school construction. Average cost savings per pupil after consolidation declined with district size from 32% for consolidating two 300 student districts to 14% for consolidating two 1,500 student districts. Duncombe and Yinger (2007) focus on monetary costs of school services and not the time costs; they find economies of size over a larger range of schools.

Anderson and Kabir (2000) utilize a stochastic frontier function rather than a cost function approach and adjust for measures of teacher quality. Overall they find that dif-

ferences in teacher quality can explain much of the school inefficiency measured across the stochastic frontier, and teacher quality is correlated with district enrollment.

Ratcliffe et al. (1990) examine Nebraska school districts' fiscal condition or the ability to provide educational services of average quality at an average tax burden on its residents. They find that school districts vary in their revenue-raising capacities, in their expenditure needs, and thus in the difference between expenditures needed and revenue raised (that is, need-capacity gap). However, they also find that on average the largest and smallest districts are in better fiscal condition than districts with enrollments between 100 and 1,000 students. That is, they argue that the medium-sized districts do not have the high per-student income that the smallest districts have, nor can medium-sized districts take full advantage of economies of size. As a result medium-sized districts tend to have both relatively low ability to generate revenue and relatively high expenditure needs.

CONSOLIDATION AND ACADEMIC OUTCOMES

After reviewing production function studies since 1980, Andrews et al. (2002) conclude that the strongest studies have not focused on size as a key determinant, and overall the results are mixed at the district level but are more consistent at the school level.[3] Among the school-level studies, they find the literature suggests that decreasing returns to size may appear for high schools above 1,000 students and elementary schools above 600 students. The primary shortcoming of the existing production function studies is the use of cross-sectional specifications that do not account for unobserved heterogeneity among schools or districts. Failing to control for the unobserved characteristics of the schools or districts that may be correlated with both student performance and size will result in biased estimates.

Kuziemko (2006) isolates the effect of school size on student performance by using school-level data for Indiana from 1989 to 1998 and employing first-differences and two-stage least squares estimation. Both methods indicate a negative effect of school size on student achievement. The two-stage least squares estimates suggest that doubling enrollment leads to a 4.1 percentage point decrease in math scores and a 0.4 percentage point decrease in attendance three years later. Moreover, in an exploratory cost-benefit analysis, Kuziemko (2006) concludes that reducing the size of schools may be a cost-effective strategy to increase student achievement.

Leach et al. (2010) address endogeneity and selection issues by exploiting an education policy change in the province of Ontario. In 1998 the newly elected government ordered widespread consolidation within the province of Ontario's public school system, reducing 62 districts into 25 districts. The consolidation was accompanied by a move to full provincial funding of school districts, causing a redistribution of funds from rich districts to poor districts. Overall the results indicate a general improvement in student performance. However, when the effect of consolidation is allowed to differ by the wealth of the district, the results indicate that students in previously high wealth school districts perform worse after the policy change compared to students in previously low wealth school districts.

CONSOLIDATION AND NON-MONETARY COSTS

Blauwkamp et al. (2011) look beyond monetary costs to examine other benefits that schools provide to communities, in particular the role that schools play in building and maintaining communities. A related strand of studies considers additional issues related to school consolidation. Surveying school superintendents in eight states involved in school consolidations, Alsbury and Shaw (2005) examine the consequences of consolidation for students, communities, and school personnel. Benefits included more course offerings, greater availability of specialized student services, and larger facilities. In terms of the community that lost a school, the costs included lost prestige, population decline, and concerns about lost control of students' education.

DATA AND EMPIRICAL STRATEGY

Data

School district–level information on district size and expenditures was obtained from the Nebraska Department of Education. District size is measured by average daily membership. Average daily membership is larger than average daily attendance because it includes all students in the district regardless of whether they attend school every day. An average is necessary because the number of students can vary over the year as students move into or out of the district; transfer between public schools, private schools, or homeschooling; or drop out of school. Moreover, schools are likely to plan most variable costs (such as class sizes) based on membership rather than day to day attendance rates. Per-pupil expenditures are measured as expenditures per average daily member. These data were

collected for the 2010–11 school year as well as for the historical time period 1992–93 to 2004–5.

For the 2010–11 school year we also obtained district-level information on student outcomes, input prices, and environmental factors. Our student outcome measures include average ACT scores and high school cohort graduation rates. The input price is captured using the average salary of all teachers in a district. Environmental factors represent those factors that are outside of the control of district officials and include the percent of the school district population that receives free or reduced lunch, the percent of the school district population that is enrolled in special education classes, and the percent of school district population that are secondary students. For the time period 1992–93 to 2004–5, we obtained cumulative district dissolutions information and identified a sample of consolidated and nonconsolidated school districts (see Empirical Strategy subsection for details).

EMPIRICAL STRATEGY

Our goal is to examine how the monetary cost of public primary and secondary education in Nebraska varies by school district size, and whether these costs are expected to rise or fall after districts consolidate. We employ two strategies. The first strategy is to examine the relationship between per-pupil spending and district size (average daily membership) using the sample of 251 public school districts operating in Nebraska during the 2010–11 school year. This estimation controls for student outcomes (cohort graduation rate and ACT scores), input prices (average teacher salary), and environmental factors (percent of district population receiving free or reduced lunch, percent of the district population enrolled in special education classes, and percent of district population who are secondary students). These control variables may influence costs if lower income students, special education students, and high school students are more expensive to educate than higher income students, non–special education students, and elementary students. Furthermore, education costs are expected to be higher for schools that are achieving higher student outcomes.

The primary variable of interest is average daily membership and we include a quadratic term to determine if cost per pupil reaches a minimum. The implication of identifying a minimum cost district size is that for districts that are smaller than the minimum cost district size, district growth (perhaps through consolidation) leads to monetary cost savings. Although this analysis allows us to identify any empirical regularities between district size and per-pupil cost, it does not specifically test how consolidation may influence per-pupil monetary costs. Moreover, depending on how large the minimum cost district size is, it may not be feasible for small rural districts to achieve even with mass consolidation.

Our second and preferred strategy directly examines the impact of school district consolidation on per-pupil spending in Nebraska using a sample of 381 consolidated and nonconsolidated districts from 1992–93 to 2004–5. This historic period is examined because in June 2005 the Nebraska Legislature enacted Legislative Bill 126, which eliminated all elementary only (Class 1) and high school only (Class 6) districts by requiring them to merge into K–12 districts by the 2006–7 academic year.[4] From 2005–6 to 2006–7 alone the number of school districts declined 45%, and since 2006–7 fewer than 8 additional school districts have closed. Conversely, over the 13 years from 1992–93 to 2004–5, the number of school districts declined 33%. Although over this historic time period there was incentive to consolidate through the structure of school financing, we focus on school district consolidations prior to 2005–6 because they primarily reflect consolidation by choice rather than mandated consolidation and would be the most likely to be instructive about the monetary cost savings from future school consolidations in Nebraska.

Nonconsolidated districts are defined as school districts that never closed or consolidated from 1992–93 to 2004–5. Consolidated districts are defined as school districts that consolidated at some point over the 9-year study period from 1994 to 2002 and remained opened through the 2004-5 academic year. A district may have been dropped from the sample for the following reasons. First, we required that a consolidated district have 2 years of data before and after the study period; if a district consolidated or closed during 1992–93 to 1993–94 or 2003–4 to 2004–5, the district was dropped from the sample. Second, the majority of the consolidations involved one or more existing districts receiving one or more closing districts. However, about 5% of the consolidations consisted of a new district opening upon consolidation. Because there are no pre-consolidation data on these new districts, they were dropped from the sample. Finally, we required that positive per-pupil spending be reported in each year from 1992–93 to 2004–5. This requirement resulted in 5 consolidated districts and 11 nonconsolidated districts being dropped from the sample. The final sample sizes are 134 consolidated districts and 247 nonconsolidated districts; each district has 13 years of data. Figure 1 illustrates the study design.

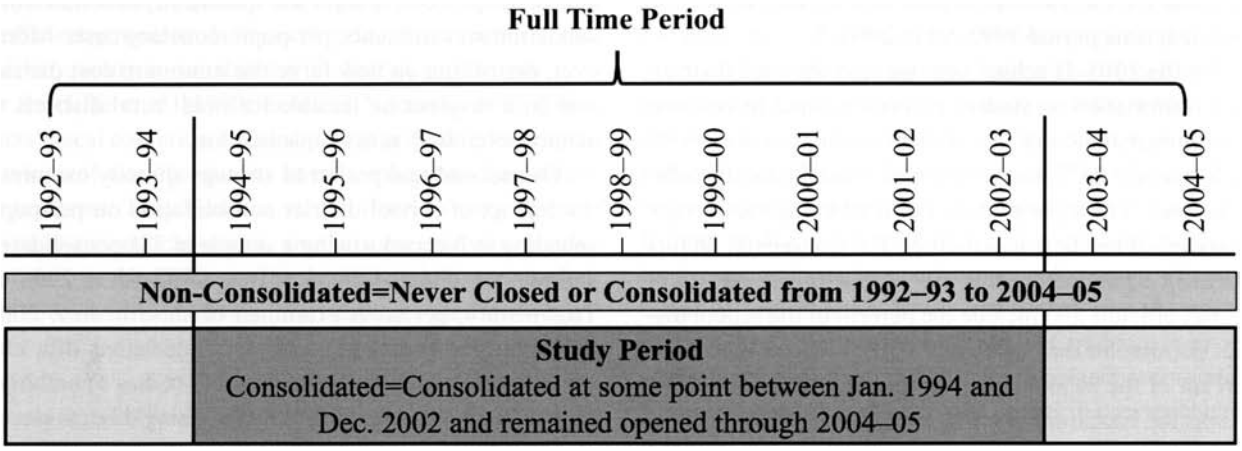

Figure 1. Consolidation study design.

To examine the effect of consolidation on per-pupil spending, we exploit the variation in timing of consolidations over the study period. That is, many of the consolidated districts underwent multiple consolidations: of the 134 unique consolidated districts, 51 districts (or 38%) underwent a second round of consolidation; and of the 51 twice-consolidated districts, 21 districts (or 41%) underwent a third round of consolidation.[5] Given our methodology we expect the initial consolidation to increase per-pupil spending as consolidation represents a spending shock at the receiving districts. However, we expect additional rounds of consolidation to decrease per-pupil spending as the receiving districts have experience with the logistics of consolidating—thus taking advantage of economies of size. This estimation controls for district size, consolidated districts, districts located in negative growth counties, time-constant district-specific unobservable effects, and year-specific unobservable effects.

Finally, the data examine school district consolidation. Such district consolidation may or may not include the consolidation of individual schools. Results, therefore, reflect the potential administrative costs savings from school district consolidation and also reflect some school consolidation activity. However, the results are not a pure test of the potential monetary savings from consolidation of individual schools.

RESULTS

Relationship between Per-Pupil Spending and District Size

Table 1 presents the estimated relationship between per-pupil spending and district size (average daily membership). Column 1 shows the binary relationship and Figure 2 plots the relationship between per-pupil spending and the natural log of membership for the sample of 251 school districts operating during the 2010–11 school year. That is, the red dots show the combination of per-pupil spending and the natural log of membership for each school district. The inclusion of the natural log of membership squared allows us to test for a nonlinear relationship between per-pupil spending and the natural log of membership. Such a nonlinear relationship is identified if the coefficient on the squared term is statistically significant. The estimated relationship indicates the relationship is nonlinear; there is a negative and statistically significant estimated coefficient on the natural log of membership and a positive and statistically significant estimated coefficient on the squared term. That is, on average, as average daily membership initially rises, per-pupil spending declines until a minimum cost district size is reached. Then districts with an average daily membership beyond this minimum cost district size experience higher per-pupil spending. These results are incorporated into Figure 2 via the blue dots. In the natural log of average daily membership the estimated minimum cost membership level is 8.54, which is equivalent to an average daily membership of approximately 5,100 students in a school district.

Of course there are many other factors that influence per-pupil spending and those factors are not controlled for in the simple binary relationship shown in Table 1, column 1 or in Figure 2. Column 2 of Table 1 presents results that account for factors other than average daily membership. These factors include student outcomes, input prices, and environmental factors outside the control of district officials. The results indicate the student outcome variables,

TABLE 1. MEMBERSHIP SPENDING WITHOUT AND WITH CONTROL VARIABLES

	OLS estimation					
	Total cost per average daily member					
Variable	**[1]**			**[2]**		
Intercept	53,115	(2,991)	***	46,364	(4,503)	***
Log of average daily membership	-10,481	(894)	***	-9141	(1,063)	***
Log of average daily membership squared	614	(65)	***	508	(72)	***
Average ACT				-84	(95)	
Cohort graduation rate				-29	(17)	*
Average teacher salary (dollars)				0.15	(0.04)	***
Percent free or reduced lunch				-858	(972)	
Percent special education				6,358	(2,756)	***
Percent secondary students				-1,841	(2,278)	
Adjusted R^2	0.531			0.718		
Minimum cost enrollment	5109			8059		
n	251			251		

Note: Variable values were missing for some control variables in some counties. This issue primary pertained to the average ACT variable, and to lesser extent, the graduation rate. In 2010–11 fiscal year data, there were 39 observations with missing values for the district average ACT score, 16 observations with missing values for the district graduation rate, 4 for average teacher salary in the district, 4 for percent of students in special education, 2 for percent of students who received free and reduced lunch, and 1 for share of secondary students. In the regression analysis, observations with a missing value for a variable were assigned a value of 0. Further, there was an indicator variable associated with each control variable. When the value for an observation was missing for that variable, the indicator variable was given a value of 1; otherwise the indicator variable received a value of 0. This technique is equivalent to substituting the mean value for a control variable in cases where an observation is missing in the data.

*denotes significance at the 10% level, **denotes significance at the 5% level, ***denotes significance at the 1% level.

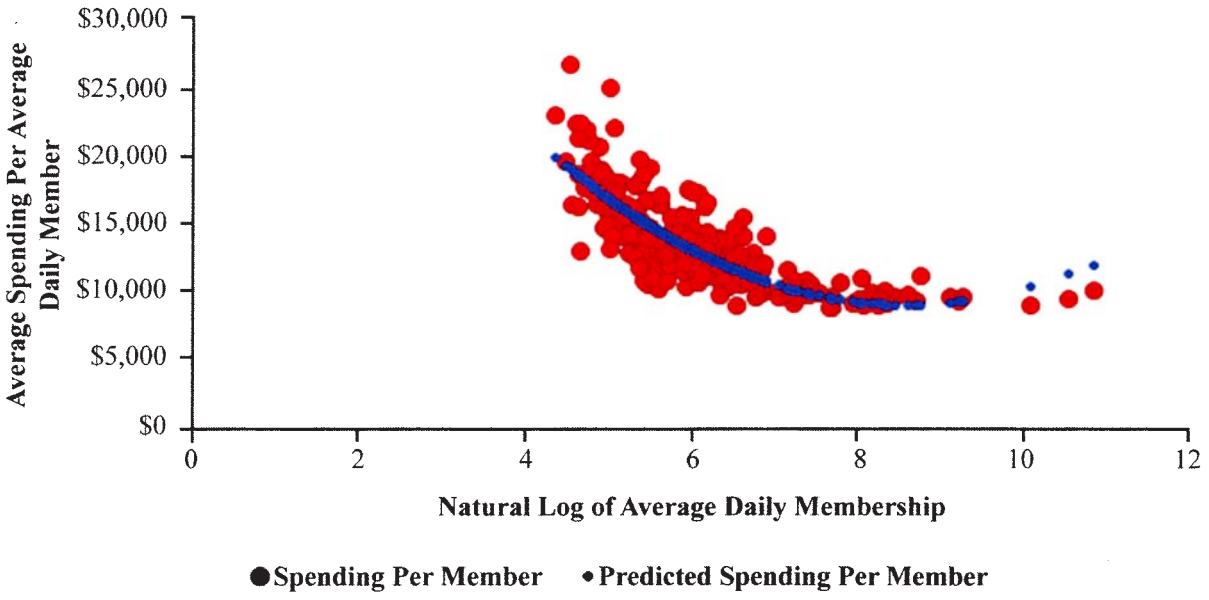

Figure 2. Per-pupil spending and the natural log of membership, 2010–11.

average ACT score, and cohort graduation rate are negatively associated with per-pupil spending; however, the estimated coefficient on average ACT score is not statistically significant and the estimated coefficient on cohort graduation rate is only weakly statistically significant at the 10% level. Although education costs are expected to be higher for schools that are achieving higher student outcomes, a possible interpretation for our result is that a higher cohort graduation rate implies more students are completing their high school degree in 4 years—thus not requiring additional funds to be spent on them beyond 12 years. The estimated coefficient on average teacher salary is statistically significant and indicates that, on average, a $1,000 increase in average teacher salaries increases per-pupil spending by $150. Of the environmental variables only the percent of students enrolled in special education classes is statistically significant. The estimated coefficient indicates that, on average, a one-percentage-point increase in the number of students enrolled in special education classes increases per-pupil spending by $6,358.

The average daily membership results in column 2 are qualitatively similar to those presented in column 1—that is, the estimated coefficient on the natural log of enrollment is negative and statistically significant while the estimated coefficient on its square is positive and statistically significant. These results imply that per-pupil spending falls initially, reaches a minimum cost point, and then begins to rise slowly. There is, however, a difference in the magnitude of the estimated coefficients on the natural log of enrollment and its square when the control variables are accounted for. Specifically the magnitude of the estimated coefficients rises after the control variables are included; thus, the minimum cost average daily membership rises from approximately 5,100 without the control variables to approximately 8,000 with the control variables.

These results suggest economies of size persist throughout much of the enrollment range in our sample, as the average daily enrollment for all Nebraska school districts in 2010–11 is 1,130, and only 2% have an average daily enrollment of 8,000 students or more. But although this analysis is informative in terms of providing an estimate of the so-called ideal district size and implies implementing policy that encourages consolidation, it does not specifically test how consolidation may influence per-pupil monetary costs. Moreover, the ideal district size is infeasible for small rural districts to achieve even with mass consolidation. Next we present results of the impact of consolidation from our longitudinal analysis that includes a control group while examining pre- versus post-consolidation costs.

THE ROLE OF PROPERTY VALUES

In Figures 3 and 4 we supplement our findings on the cross-sectional relationship between natural log of membership and spending per pupil with an analysis of the cross-sectional relationship between assessed property values and the natural log of membership. Assessed property value data are provided for both 2011 and 2006, respectively. Results are also presented for 2006 to examine the relationship before the recent steep run-up in agricultural land values. The tax base in both figures reflect assessed values and therefore reflect that Nebraska assesses agricultural property at a lower rate (75% of market value) than other types of property (90%).

The relationship between property tax base per member student and district membership is similar to the per-pupil spending and district size relationship presented in Figure 2. In particular, property tax base per average daily member falls sharply with the natural log of membership. The correlation coefficient between the natural log of average daily membership and property tax base per member has a negative value in both 2006 (-0.52) and 2011 (-0.56). Note that this pattern is evident in 2006 as well as 2011. In other words, the pattern predates the recent sharp run-up in agricultural land prices and is a more permanent feature of Nebraska's school tax base. The findings in Figures 3 and 4 raise an intriguing possibility. Higher spending per student in low-membership school districts in our cross-sectional analysis may in part reflect the presence of a larger tax base to support education spending. The pattern in Figure 2 may reflect a desire by high-resource districts to spend more on education as much as it reflects technical economies of size that drive down average costs as school district membership rises.

To the extent that higher spending per pupil in low membership districts reflects economies of size, the results also raise the possibility that at least some low-membership school districts may have sufficient tax bases to help offset higher costs. In other words, while school districts may exhibit economies of size, some low-membership districts may serve largely agricultural districts, which would tend to have high levels of potentially taxable property per student. The key question is whether this agricultural property will be taxed at the same rate as other types of property. As noted above agricultural property is taxed at a somewhat lower rate in Nebraska; and given the political power of agricultural interests, there may be even larger discrepancies in other states between tax rates on agricultural and other property, and the gap may grow in Nebraska in the future. Another

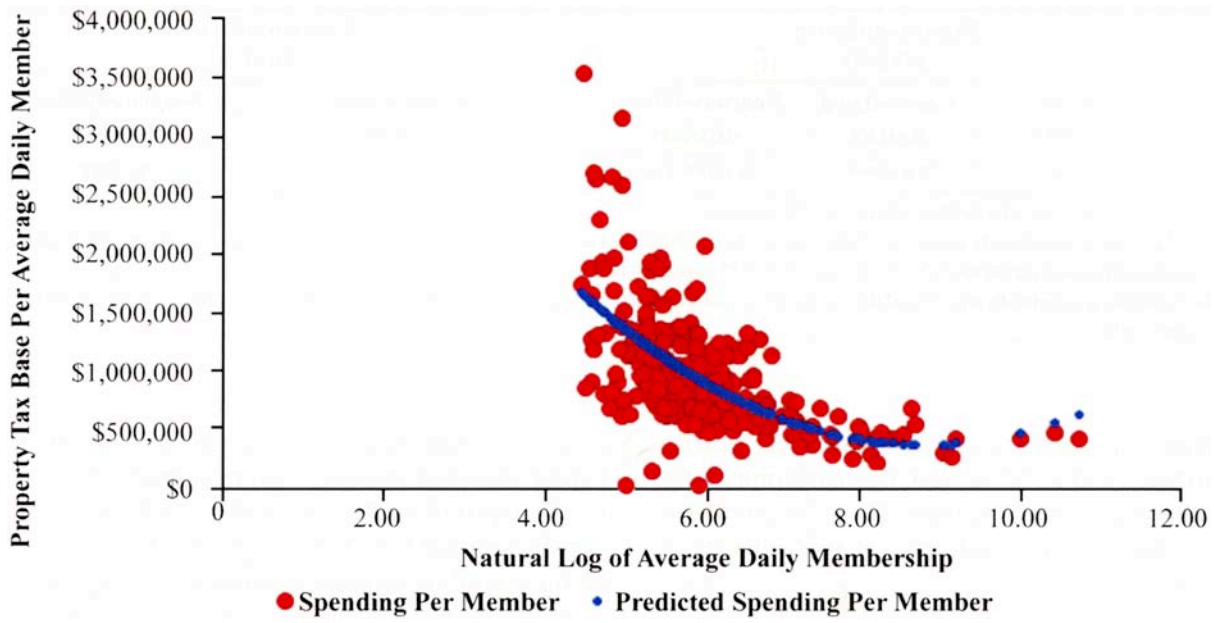

Figure 3. Property tax per student and the natural log of membership, 2011.

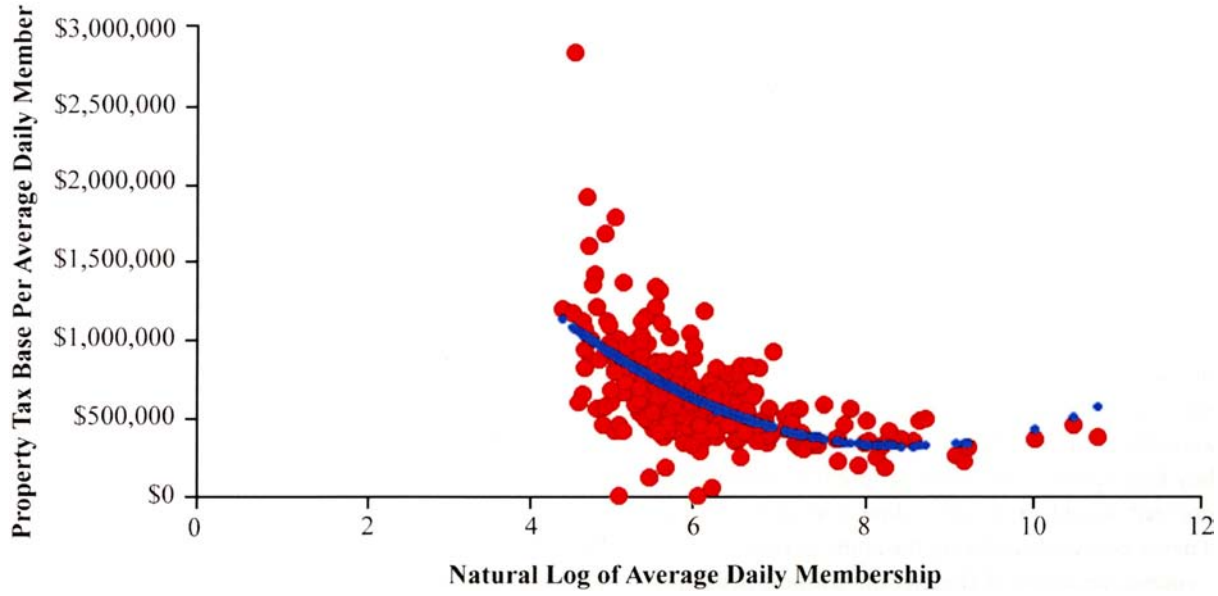

Figure 4. Property tax per student and the natural log of membership, 2006.

TABLE 2. PRE- VERSUS POST-CONSOLIDATION COMPARISONS OF REAL PER-PUPIL SPENDING

Pre-consolidation 1992–93			Post-consolidation 2004–5	
Closed districts	Consolidated district	Nonconsolidated districts	Consolidated district	Nonconsolidated districts
9,660	7,815***	8,698* †††	11,730	12,500

Note: All figures have been adjusted for inflation to 2012 dollars.

Asterisks (*) denote a statistically significant difference in the per-pupil cost between consolidated districts and closed districts or nonconsolidated districts and closed districts (*p-value < 0.10, *** p-value < 0.01).

Daggers (†) denote a statistically significant difference in the per-pupil cost between consolidated districts and nonconsolidated districts (††† p-value < 0.01).

important point is that many low-enrollment districts primarily serve small towns, with limited territory in the surrounding agricultural districts. These low-enrollment districts would not have high levels of assessed property per student.

IMPACT OF CONSOLIDATION ON PER-PUPIL SPENDING

Table 2 shows real per-pupil spending in 1992–93, before our sample of consolidated districts consolidated, and in 2004–5, after our sample of consolidated districts consolidated. Specifically, the table compares per-pupil cost for consolidated districts with nonconsolidated districts in the two time periods. In 1992–93, per-pupil cost in consolidated districts (prior to consolidation) was $883 lower than per-pupil cost in nonconsolidated districts; however, in 2004–5 (after consolidation), per-pupil spending was higher for both types of districts and no longer significantly different. Note that the 1992–93 per-pupil cost in closed districts (prior to closing during consolidation) were significantly higher than per-pupil cost in both consolidated and nonconsolidated districts. This comparison suggests that even before consolidation took place, there was something unique about consolidated districts such that they had significantly lower per-pupil spending than districts that would eventually close and districts that would never consolidate during the study period.

Of course the simple differences in average per-pupil cost before and after consolidation do not tell us the impact of consolidation. There are many other variables that influence per-pupil spending in each district, and changes in those variables also are reflected in the simple differences shown in Table 2. Table 3 presents the results of a regression model that estimates the association of multiple rounds of consolidation on per-pupil spending in rural districts while controlling for district size, district location, district-specific fixed effects, and year fixed effects.[6] For the sake of comparison, column 1 presents the results for the impact of the first consolidation only on per-pupil spending in rural districts. First the estimated coefficients on the control variables are consistent with expectations as well as with our previous findings. That is, findings from our 2010–11 cross-sectional analysis indicate that districts with higher average daily membership have lower per-pupil spending (at least up to 8,000 students). We capture this relationship in Table 3 with the binary Class 3 variable. The estimated coefficient indicates that per-pupil spending are 3.8% lower in Class 3 rural districts, which have higher student populations compared to Class 2 districts or Class 1 and 6 districts that maintain elementary and high school grades only; however, the estimate is not statistically significant. Consistent with the simple differences in average per-pupil cost before and after consolidation presented in Table 2, the estimated coefficient on the binary consolidated district variable indicates that, on average, per-pupil spending is 16.6% lower across all years in consolidated rural districts compared to nonconsolidated rural districts. That is, independent of the impact of consolidation, consolidated districts in our sample have significantly lower per-pupil spending compared to the control group of nonconsolidated districts. Finally, per-pupil spending is 7.4% higher in rural districts located in negative-growth counties compared to rural districts located in positive-growth counties, which is consistent with expectations.

For the purposes of this study, the most important coefficient is the estimated impact of consolidation, captured with the First consolidation variable, on per-pupil spending. According to the point estimate and using nonconsolidated districts as a control group, per-pupil spending is 2.7% higher post-consolidation compared to pre-consolidation. The estimate is marginally statistically significant (p-value is 0.1040), and is consistent with the

TABLE 3. IMPACT OF CONSOLIDATION ON PER-PUPIL SPENDING IN RURAL DISTRICTS

	GLS estimation			
Variable	**[1]**		**[2]**	
Consolidation variables				
First consolidation (0-1)	0.027	(0.017)	0.033	(0.018) *
Second consolidation (0-1)			-0.051	(0.015) ***
Third consolidation (0-1)			0.027	(0.021)
Other regressors				
Class 3 district (0-1)	-0.038	(0.025)	-0.038	(0.025)
Consolidated district (0-1)	-0.172	(0.025) ***	-0.166	(0.025) ***
District located in negative-growth county (0-1)	0.074	(0.033) **	0.074	(0.034) **
Year fixed effects	Yes		Yes	
District fixed effects	Yes		Yes	
n*T	3,016		3,016	

Note: GLS covariance allows for first-order autocorrelation and error correlation across school districts. The dependent variable is the natural log of real per-pupil spending. First consolidation equals 1 in year t and thereafter if district consolidated for the first time in year t. Second consolidation equals 1 in year t and thereafter if district consolidated a second time in year t. Third consolidation equals 1 in year t and thereafter if district consolidated a third time in year t.

*denotes significance at the 10% level, **denotes significance at the 5% level, ***denotes significance at the 1% level.

TABLE 4. IMPACT OF CONSOLIDATION ON PER-PUPIL SPENDING IN NON-RURAL DISTRICTS

	GLS estimation			
Variable	**[1]**		**[2]**	
Consolidation variables				
First consolidation (0-1)	-0.009	(0.018)	-0.008	(0.017)
Second consolidation (0-1)			-0.003	(0.016)
Third consolidation (0-1)			0.021	(0.02)
Other regressors				
Class 3 district (0-1)	-0.072	(0.038) *	-0.072	(0.038) *
Class 5 district (0-1)	-0.108	(0.015) ***	-0.108	(0.015) ***
Consolidated district (0-1)	-0.055	(0.031) *	-0.055	(0.031) *
District located in negative-growth county (0-1)	0.015	(0.051)	0.015	(0.051)
Year fixed effects	Yes		Yes	
District fixed effects	Yes		Yes	
n*T	1,937		1,937	

Note: GLS covariance allows for first-order autocorrelation and error correlation across school districts. The dependent variable is the natural log of real per-pupil spending. First consolidation equals 1 in year t and thereafter if district consolidated for the first time in year t. Second consolidation equals 1 in year t and thereafter if district consolidated a second time in year t. Third consolidation equals 1 in year t and thereafter if district consolidated a third time in year t.

*denotes significance at the 10% level, **denotes significance at the 5% level, ***denotes significance at the 1% level.

notion that there is a spending shock at the receiving districts when consolidation occurs.

To investigate this further, column 2 of Table 3 estimates the impacts of the second and third rounds of consolidation in addition to the first round. As expected the impacts of the first and subsequent rounds of consolidation differ. On average the first consolidation among rural districts increases per-pupil spending by 3.3%, reflecting a spending shock or adjustment cost. However, the second round of consolidation reduces per-pupil spending by 5.1%, suggesting the adjustment cost fades over time. Perhaps this is due to the receiving districts' gaining experience with the logistics of consolidating, which allows them to take advantage of economies of size. Although the estimated impact of the third round of consolidation is positive, it is not statistically different than zero.[7] Overall,

given the average per-pupil cost among rural districts in the sample, the majority of consolidated districts in our sample experienced an average increase of about $340 per pupil post-consolidation. For 38% of the consolidated districts who underwent a second round of consolidation, per-pupil spending eventually decreased by about $530, on average, post–second consolidation.

Table 4 presents analogous results to Table 3 for the non-rural districts. Overall the impact of consolidation for non-rural districts differs from rural districts. That is, none of the rounds of consolidation are statistically significantly different than zero, suggesting that post-consolidated per-pupil spending is no different than pre-consolidated per-pupil spending. However, the estimated coefficients on the control variables are consistent with those found for rural districts. Non-rural districts with higher student populations (e.g., Class 3 and Class 5) have lower per-pupil spending, on average.[8] Also, independent of the impact of consolidation, consolidated districts in our non-rural district sample have statistically significantly lower per-pupil spending compared to the control group of non-rural, nonconsolidated districts.

In summary, the regression results control for more factors that may affect per-pupil spending over time than a simple comparison of pre- and post-consolidation costs and therefore more accurately capture the cost savings from consolidation.[9] Overall the results do not consistently indicate that consolidation leads to lower monetary costs per pupil. Rural districts in our sample experienced lower expenditures only if multiple consolidations occurred over time and began only with the second consolidation. For rural districts with only one consolidation per-pupil spending was higher in the post-consolidation time period compared to the pre-consolidation time period, and for non-rural districts per-pupil spending was no different in the post- versus pre-consolidation time period.

CONCLUSION

This article examines the relationship between school district size, as measured by student membership, and educational spending in the state of Nebraska, a geography that provides a good representation of the tradeoff between district size and spending for the Great Plains region. The study utilizes a rich database of district spending and membership that has been maintained by the Nebraska Department of Education for the past two decades. These data allow for both a cross-sectional and a time-series, cross-sectional analysis of membership and per-pupil spending. The latter analysis allows for a comparison of pre- and post-consolidation per-pupil spending.

As is true for most studies of school district spending, we lack information on the time investment in education by students and parents in studying and in transportation to and from school. We also acknowledge that differences between the property tax base of school districts, state aid, and state regulation of local taxation also influence the per-pupil spending patterns of school districts.

With these caveats, our analysis found a U-shaped relationship between the average monetary spending per enrolled student and the number of students per school district. In our fully specified cross-sectional model, average spending per enrolled student reaches a minimum in districts with 8,000 enrolled students. Although this empirical relationship may occur for a variety of reasons, the results suggest there is potential monetary cost savings from school district consolidation in most Nebraska school districts, given the average enrollment for all Nebraska school districts in 2010–11 is 1,130 students and only 2% have an enrollment of 8,000 students or more. However, our time-series analysis of per-pupil spending before and after consolidation failed to find consistent evidence that consolidation lowered per-pupil spending in either rural or non-rural districts. This result suggests that savings from school district consolidation, if any, may be small despite the observed U-shaped pattern between school district membership and per-pupil spending.

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NOTES

1. In education, consolidation refers to combining school districts and closing schools and sending students to other receiving schools (Howley et al. 2011).

2. Howley et al. argue the benefits of fiscal efficiencies are small because they involve only the smallest districts, which enroll very few students (Howley et al. 2011).

3. A vast literature exists on the relationship between school inputs and student performance through the use of education production functions (see Hanushek [1986]; Hedges et al. [1994]; and Verstegen and King [1998] for in-depth reviews of this strand of literature). Although class size is a common school input used in education production functions, few studies include school or district size (Andrews et al. 2002), which is the focus of this study.

4. Nebraska school districts are defined by class to designate the specific grade levels and population associated with the territory of the school district. Classes are defined as follows: Class 1—elementary only; Class 2—elementary and high school with area population of 1,000 or less; Class 3—elementary and high school with area population between 1,001–99,999; Class 4—elementary and high school in Lincoln only; Class 5—elementary and high school in Omaha only; and Class 6—high school only.

5. Additional rounds of consolidations occurred for the three-time-consolidated districts; however, the sample is too small to obtain reliable results.

6. Although not shown, we find significant cost differences among districts located in rural versus non-rural counties, thus we run separate regressions for each. Specifically we find the per-pupil cost difference between districts in rural versus non-rural counties increased nearly fourfold from the pre-consolidation ($577) to post-consolidation ($2,248) time period. A rural county is defined as a county that is not part of a metropolitan or micropolitan statistical area based on current U.S. Census Bureau definitions.

7. We also tested the null joint hypothesis that the coefficients on the first, second, and third consolidation variables are zero. Overall, the F-test rejects the null hypothesis that the set of all consolidation variables has no effect at the one percent level.

8. Forty-six percent of non-rural districts are classified as Class 1 districts and 3% each are classified as Class 2 and Class 6 districts. Lincoln Public Schools is classified as the only Class 4 district. It was dropped from the sample because it received a district during the two years before the study period and thus did not satisfy the study design specifications.

9. It should be noted that our longitudinal analysis does not account for school quality. If consolidation influences school quality, there may be effects on the time to graduate and the dropout rate. These are important factors. According to Bureau of Labor Statistics data, individuals with less than a high school diploma are 1.6 and 3.2 times more likely to be unemployed than high school graduates and college graduates, respectively.

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