A Report to the

School District Redistricting Commission

Prepared by
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March 15, 2006

Executive Summary

This report examines empirical studies, literature reviews and statistical data from government sources that address the effects of school district size on economies of scale, student achievement, efficiency and reform.

The findings of the studies on economies of scale were:

- Using data from all states, with the state as the unit of analysis, there was no evidence that larger school districts result in lower expenditures.
- In Utah, administrative costs were higher for districts with fewer than 1,000 students.
- Per pupil costs indicated economies and diseconomies of scale in Colorado, South Carolina , Arkansas, New York, Maine and Minnesota.
- Per pupil expenses in Iowa decreased as enrollment increased.
- In Georgia per pupil costs decreased as enrollment increased in high schools, but not at the elementary or middle school level.

The findings of the studies on student achievement were:

- School district size does not have a significant direct relationship and indirectly has a very slight effect on student achievement in Colorado.
- There is a negative relationship between SES and student achievement. Small school districts help low SES students break this relationship, while large districts help high-SES student achievement in Arkansas, California, Nebraska, West Virginia, Georgia, Montana, Nebraska, Ohio, Texas, Utah and Washington .
- In New York and a rural region of Texas student achievement was higher in larger school districts.
- In South Carolina the size of a school district had no impact on student achievement at the elementary level, although low SES middle and high school students performed better in smaller school districts.

The findings of the studies on school district efficiency were:

- A New Jersey study found that smaller school districts were more efficient in providing a quality education.
- Studies examining school district efficiency in Arkansas found that school districts of various sizes were efficient. However, many of the smallest school districts were not found to be efficient because of their per pupil costs in the areas of administration and operations and maintenance.

The one study on school district implementation of reform found that larger districts are better able to facilitate reform because they have greater specialized areas of

expertise, slack resources available to direct to reform due to economies of scale and better access to technical assistance.

The study results can support a wide variety of conclusions, but there are some consistent findings among the studies. Economies of scale exist as school districts grow in size, but diseconomies of scale arise if districts become too large. Generally, low SES students perform better in smaller districts, while high SES students may perform better in large districts. However, not all the relevant studies found these results. An increase in competition to some threshold level appears to improve student achievement and efficiency. What is not clear is whether competition takes place at the school or school district level.

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Introduction

The possible cost benefits of consolidating school districts have become a recent focus of attention in Arizona. In 2002, the Office of the Auditor General (OAG) issued a report to the Arizona Legislature that identified factors that help explain differences in school districts with particularly high or low per-pupil administrative costs. The OAG report found that on average, small school districts spent more per pupil than large districts.

In 2005, the School District Redistricting Commission was created for the purpose of reviewing Arizona school districts and making recommendations for their unification or consolidation. By December 31, 2007, the commission must submit a plan to the governor regarding proposed school district unification.

This report examines literature and summarizes the findings of empirical studies that have focused their research on school district size in relation to per pupil costs, student achievement, efficiency and school choice.

History of school district centralization

During the early twentieth century the principles of scientific management were extended to education. The industrial principles of specialization, centralization and standardization became an essential part of educational decision making (Miley & Associates, 2003).

Estimated figures indicate that there were over 250,000 schools and between 125,000 and 150,000 school districts in the United States at the turn of the twentieth century (NCES 2004, Howley, 1999). The number of school districts saw a steady decline from 1939 to 1973, averaging 13 percent per year (Killeen & Sipple, 2002). In 1939, there were 117,108 school districts and 226,762 schools in the nation. By 1973, the number of school districts had dropped to 16,730 with about 90,000 schools (NCES 2004, Table 85). Since that time, the decline in the number of school districts in the nation has slowed and there are currently about 14,500 (NCES 2004, Table 85).

School district consolidation in Arizona has been more limited. There were 384 school districts in Arizona in

A unified school district includes both primary (kindergarten through junior high) and secondary (high school) schools.

1928. This number dropped to 295 in 1970. In 2003, Arizona had 208 regular school districts: 108 elementary school districts, 15 high school districts and 95 unified school districts. In addition there were sixteen accommodation districts[1] and nine transporting[2] districts. Provisions for the structure and supervision of public education in Arizona can be found in the Constitution of Arizona, article XI, sections 1 and 2 and Arizona Revised Statutes (A.R.S.) chapter 4, articles 2 and 3. Requirements for elections to approve the subdivision or consolidation of school districts are provided for in A.R.S. sections 15-458 and 15-459. Subdivision or consolidation plans must be approved by voters in the affected communities.

School District Statistics and Characteristics

According to the U.S. Department of Education, National Center for Education Statistics (NCES), there were 14,465 regular school districts serving 48,183,086 students in the United States in 2002-03. Most school districts served kindergarten through grade 12 students; while districts in some states have separate districts for the various grade spans. The average school district had 5.6 schools and 3,319 students. The majority of school districts, 73 percent, had fewer than 2,500 students, but these districts only served 17 percent of all students. Districts with 2,500 students or more enrolled 83 percent of students (NCES, 2005).

The largest school districts in the nation tend to be in cities and counties with large populations and have larger schools than the national average. Although a larger percentage of staff are teachers (52 percent) in the largest districts than nationwide (51 percent), the largest districts also have a higher median pupil to teacher ratios, 16.9 to 1 compared with 15.9 to 1. The largest districts also have higher numbers of poor students as measured by eligibility for free or reduced-priced lunch programs, higher percentages of minority students than schools nationwide and a disproportionate percentage of students eligible for the free and reduced-price lunch program.

The median number of districts for the states is 180 with the largest number in any state being 1,039 in Texas and the smallest number being one in Hawaii.

[1] An accommodation school district is administered to serve a military reservation or territory that is not included within the boundaries of a school district or provides educational services to homeless children or alternative education programs. Accommodation districts are operated though the county board of supervisors and the county school superintendent.

[2] Transporting districts do not provide actual instruction to students within their boundaries, but instead contract with neighboring districts for these services.

Arizona School Districts

Arizona follows the nationwide trend of the majority of students being served by relatively few large districts. Approximately 7 percent (23) of Arizona's school districts enroll more than 10,000 students compared to 6 percent of school districts nationwide. Of the 100 largest school districts in the nation, Arizona has two: Mesa Unified School district, with about 75,000 students, and Tucson Unified School district, with about 62,000 students.

However, Arizona has a larger percentage of districts in the smaller ranks than at the national level. 62 percent of Arizona school districts enroll fewer than 1,000 students compared to 48 percent nationwide.

As would be expected, the smallest Arizona school districts are in rural areas and the largest are in urban and suburban areas. Urban and rural school districts enroll nearly 88 percent of Arizona's students. Nationwide urban and suburban school enrollments are 77 percent.

Reasons for Consolidation of School Districts

The movement for district consolidation began as a trend toward the professionalization of education in the late nineteenth century (Berry, 2003). Larger schools and school districts were seen as providing positive educational and social progress through centralization of authority and were often promoted by state governments through fiscal incentives. Most school district consolidations were due to efforts to lower costs and were based on the idea of "economies of scale". This term is used in economics to describe the process of decreasing production costs per individual unit by producing products in large quantities. In regard to education, the terms "economies of scale" or "economies of size" indicate that it costs more per pupil to educate students in small schools and small districts than in large schools and large districts (Ward & Godshall, 1999).

Economies of Scale
Reduction in cost of production per unit due to a large number of items produced.

Diseconomies of Scale
Increase in marginal costs of production due to a large number of items produced.

School District Literature

For this report we examined empirical studies, literature reviews and statistical data from government sources. The report focuses on the empirical studies, but the literature reviews are noted in the table of references. The studies are organized in four general categories—Economies of Scale, Student Achievement, Efficiency and Reform.

As this report shows, the results of the empirical studies are quite varied. Therefore, comparisons are difficult. Many differences arise, because the structure of the school systems in the 50 states varies greatly. Political, historical and geographic differences among

the states have led to the creation of 50 different school systems. Each study begins at a different starting point, the unique school system of that state.[3] Therefore, the studies must be evaluated in the context of the particular state school system.

The results of the studies may appear to vary because of the type of analysis performed on the data. The empirical studies present information in a number of different ways. The most basic of these are descriptive statistics. These statistics summarize the raw data in a meaningful way to describe some aspect of the school district, its students or its environment. Descriptive statistics include ratios, frequency distributions, means and standard deviations.

A second step in many of the analyses was to compare the statistics for two groups and then determine if there were significant differences between the two categories. For example, the test scores of large and small districts might be compared. The researcher hypothesizes that no differences exist between the two groups and determines if this hypothesis can be rejected at a certain degree of certainty based on mathematical tests.

Even though statistically significant differences may exist between the scores for two groups, there may be factors that account for the differences other than the ones the researcher is studying. Therefore, the researcher must remove the effect of these other variables. The researcher may find significant differences between the SAT scores of students in big districts and small districts. However, big and small districts may vary in terms of race, socioeconomic status, class size, teacher experience or any other variables that may affect test scores. What the researcher wants to determine is, if all these other variables were equal, would there exist differences in test scores between students from large and small districts.

The method of controlling for these other variables is analysis of covariance. The underlying rationale for the analysis of covariance is the idea of using prediction equations to predict the values of the dependent variable on the basis of the values of the covariate variable, and then subtracting these predicted scores and means from the corresponding values of the dependent variable.

The researcher may also want to determine the strength of the relationship between variables. In research such as this in which a number of variables can explain the affects on what the researcher is examining, multiple regression is

[3] An extreme example of this effect is shown in Hoxby (2000). The study looked in part at the relationship of small and large streams on school districts. Those findings would seem to have little relevance to an area like the Valley of the Sun.

used. The general purpose of multiple regression is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. Multiple regression also allows the researcher to answer the general question "what is the best predictor of ...".

Another tool used in much of the research is the educational production function. This methodology describes "the maximum level of outcome possible from alternative combinations of inputs. It summarizes technical relationships between and among inputs and outcomes." (Monk, 1989). A typical educational production function is $L=f(X_1, X_2, \ldots X_n)$. L is the learning outcome, while Xs are productivity factors associated with learning. (Gong, 2005)

Inputs can be external or internal. External inputs include community factors, economic factors and social and demographic factors. Internal factors include school expenditures, teacher characteristics, facilities and student characteristics. Outcomes include standardized test scores, achievement test scores and drop-out rates (Gong, 2005).

Another difficulty in comparison of studies is that similar terms are used for different concepts. These differences have a theoretical and operational component. A term can be used on a theoretical level in which a concept is defined in terms of other concepts. In research, terms are also defined on an operational level. Operational definitions actually spell out the procedures used to measure what the term describes (Blalock, 1972). For example, the conceptual definition of "academic success" might be meeting the community's expectations in educating the children in a school district. The operational definition would be meeting or succeeding a specific passage rate on a standardized test or the SAT test or exceeding a stated graduation rate.

Problems in comparisons arise when different operational definitions are associated with a single theoretical concept. While there may be a logical connection between the theoretical concept and each of the operational definitions, the use of the different operational definitions may yield different results. Therefore, differences between results in different studies may not actually be real. They may result from using different operational definitions for the same theoretical concept.

Economies of Scale Studies

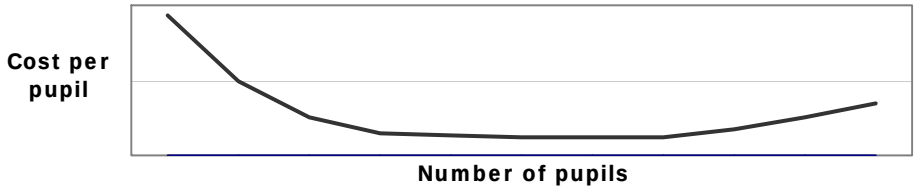
Many earlier studies found that economies of scale exist in larger schools and districts (Reilly, 2004), and it is now generally accepted that per-pupil costs are usually higher in smaller districts than they are in larger ones. Some advantages cited for larger school districts are that they can eliminate duplicative administration and support-services positions, provide fuller utilization of teachers and facilities, offer a wider range of programs of instruction, offer more efficient services due to greater specialization, spend more on educator salaries, eliminate very small and inefficient classes and gain greater negotiating power in purchasing.

Not all researchers agree that bigger districts are more cost-efficient; some also support the idea that "diseconomies of scale" may cause per pupil costs to increase again as the size of the school district increases beyond an optimal point (Ward & Godshall, 1999). While larger size may allow for savings in one area, these savings are often offset by additional expenses in another area (Goatcher, 1999). Larger districts can find it difficult and costly to manage a larger area with more schools. They may also face increased capital outlay expenditures for new buildings, higher salaries for superintendents increased employment costs for new assistant superintendents or supervisors, increased transportation costs, higher educator salaries and increased costs associated with enriched curriculum and expanded student services.

Many studies that examine the size of school districts report both economies and diseconomies of scale. Very small districts have high per pupil costs as do very large districts. When these per pupil costs are graphed against school district size, they decrease as district sizes increase, then increase again for the largest school districts showing a modified U-shaped curve. The point on this graph where the costs are lowest is sometimes called the cost-minimizing level or cost-minimizing enrollment.

Cost-minimizing level
The point at which per pupil costs are lowest in relation to school district enrollment size.

Figure 1. Typical U-shaped relationship between cost per pupil and school size



Following is list of studies that focus on per pupil costs in relation to school district size:

- Using data from all states, with the state as the unit of analysis, there was no evidence that larger school districts result in lower expenditures (Jewell, 1989).

- In Utah, administrative costs were higher for districts with fewer than 1,000 students (Cox, 2002).

- Per pupil costs indicated economies and diseconomies of scale in Colorado (Ward & Godshall, 1999), South Carolina (Miley & Associates, Inc., 2003), Arkansas (Goatcher, 1999), New York (Duncombe, Miner & Ruggiero, 1994; Duncombe & Yinger, 2001), Maine (Trostel & Reilly, 2005) and Minnesota (Hinz, 1993).

- Per pupil expenses in Iowa decreased as enrollment increased (Immerman & Otto, 2003).

- In Georgia per pupil costs decreased as enrollment increased in high schools, but not at the elementary or middle school level (Boex & Martinez-Vasquez, 1998).

Jewell (1989)

Robert Jewell (1989) looked at some effects of school systems, school district and school size for each state and the District of Columbia. He found no evidence that larger districts result in lower per pupil costs. He looked at the relationship between the average district size in each state with the state average value of a number of variables. A slightly positive correlation occurred between per pupil expenditures and average district size indicating that larger districts might in fact spend more per pupil than smaller districts.

Jewel admits that his findings, "…are *tendencies* based on relationships among averages."

In examining costs, Jewell noted that, "[i]nteresting relationships are found between average teachers' salaries and average pupil/teacher ratios. Regression analysis indicated that these two variables, taken together, account for more than 80 percent of the variation in per-pupil expenditures." Larger districts paid higher teacher salaries but had higher pupil/teacher ratios. Jewell noted that a tradeoff occurred between smaller districts that paid slightly lower teacher salaries but had lower pupil/teacher ratios and larger districts that paid higher teacher salaries but had higher pupil/teacher ratios.

Colorado Legislative Council (1999)

Colorado's school finance law includes a size factor that is intended to compensate for differences in per pupil costs that are attributable to economies of scale. The Colorado Legislative Council was directed by statute to examine the size factors established for fiscal year 1999-2000. To determine per pupil costs, the researchers modified actual district expenditures to control for a number of factors and eliminate potential bias.

The study found a relationship between size and costs that was "dynamic and curvilinear" and showed enrollment levels where the relationship between size and costs seemed to change. The per pupil expenditure levels at these enrollment levels were converted into factors on which the size factor formula was based.

The size factor directly increased a district's per pupil funding in the following ways. The smallest school districts were given the largest size factor and could receive additional funding for enrollment sizes up to 5,650. Districts with enrollments between 5,650 and 25,546 received the minimum size factor funding allowance. As district enrollments exceeded 25,546, the size factor again allowed for greater additional funding amounts, although generally at a per pupil amount that is less than for the smallest districts.

Cox (2002)

Utah school teacher and member of the Utah House of Representatives, David N. Cox prepared a study analyzing Utah school district and school size effects in 2002. Cox was critical of past consolidation efforts that resulted in large schools and school districts. He recommended setting a size limit for both schools and districts in order to improve student achievement levels and more efficiently use tax dollars.

The study focused on student achievement and cost data in regard to the largest districts in Utah and reported costs per pupil in districts of different sizes. This cost data showed that districts in Utah with fewer than 1,000 students had higher administrative costs. There was, however, little difference in administrative costs per student for districts with enrollments greater than 1,000 students.

Districts in Utah with fewer than 1,000 students had higher administrative costs.

Miley & Associates (2003)

A two part study was prepared for The Education Oversight Committee in South Carolina by Miley & Associates, Inc. (2003). Using data from each school district in the state, levels of academic performance were examined in relation to school district size (to be discussed further in this report in the section "student achievement") and an analysis of the relationship between district

size and per pupil costs was performed. Economies of scale were found to exist in South Carolina school districts.

School district expenses were divided into cost categories: instruction, instructional support, operations and leadership. These cost categories showed a negative relationship when compared to school district sizes supporting the idea that larger districts have lower per pupil costs. However, the largest districts had average costs that were greater than the state average indicating that at a certain point districts may become too large. "That is, at some point, the gains in efficiency due to economies of scale may disappear and in fact, reverse themselves." (page 51).

In South Carolina school districts with between 2,500 and 25,000 students were most cost efficient.

School districts with fewer than 2,500 students had the greatest per pupil expenditures. Districts with between 2,500 and 25,000 students were most efficient. Per student costs began increasing again for districts with more than 25,000 students.

Goatcher (1999)

In a study of school district consolidation in Arkansas between 1965 and 1995, Goatcher (1999) analyzed expenditures and per pupil costs in Arkansas school districts. Goatcher, the director of research for the Arkansas Association of Educational Administrators, looked at data from 218 school districts that participated in consolidations (some were involved in more than one consolidation) and per pupil costs for the 1996-1997 school year.

Data on costs and property tax rates for the year before and the two years following a district consolidation were examined. Of 113 school districts, only 15 reported lower spending for the year following consolidation than for the year prior to consolidation. Goatcher concluded that consolidation will not save millions of dollars. In fact, voters in these school districts voted to increase tax rates in 52 per cent of the districts in the year after consolidation. As noted above, the study only looked at the two years after consolidation. It did not look at long term effects. Also, the study looked at gross expenditures. It did not try to control for inflation or changes in student population or other factors that could affect costs. Goatcher said that the purpose of the study was to show that consolidation would not save millions of dollars, so it was not surprising that this was the author's conclusion.

When analyzing per pupil costs, Goatcher looked at data for the 1996-1997 school year. He compared per pupil costs for the largest and smallest school districts with the average per pupil costs in the state. The 100 smallest districts spent approximately 2 percent more per pupil than the state average, while the 10 largest districts spent about 15 percent more per pupil than the state average.

Goatcher's findings indicate both economies and diseconomies of scale exist in Arkansas school districts.

Duncombe, Miner & Ruggiero (1994)

Researchers Duncombe, Miner and Ruggiero (1994) analyzed school districts in New York and determined that consolidation would result in savings for districts of a certain size. They estimated how per pupil costs change as enrollment levels vary when variables other than enrollment are held at the state average.

Potential cost savings were determined by looking at the effects of school district size on economies of scale for different cost categories: instruction, transportation, operating and maintenance and central administration. Data from 610 school districts in New York in 1990 were used. Researchers controlled for differences in student achievement, factor prices and environmental factors, including fiscal capacity.

Economies of scale were found in the areas of per pupil total expenditures. Districts with about 50 students had the highest total per pupil costs. Costs for districts with about 6,500 students were lowest, but 80 percent of savings were present at a 500 student enrollment level. Total per pupil costs rose slowly above the cost minimizing enrollment of 6,500. Most cost increases came from instructional or transportation costs. The greatest potential savings were in administrative costs.

The researchers concluded that the greatest cost savings could be gained by concentrating on the consolidation of districts with 500 or fewer students. For each district that met this criterion, they examined the district's land area, pupil density and actual per pupil expenditures. The primary candidates for consolidation were districts with relatively small land areas and high pupil densities. The researchers identified 17 districts for full consolidation and 43 for administrative consolidation.

In New York, costs for districts with about 6,500 students were lowest. 80 percent of savings were reached at a 500 student enrollment level.

Duncombe & Yinger (2000)

A similar study of district consolidation in New York, Duncombe and Yinger (2000) focused on rural school districts. They found significant cost savings when two small school districts were merged, and that these cost savings were almost entirely attributable to economies of size. However, the relationship between per pupil expenditures and school district enrollment size was U-shaped.

From 1985 to 1997, 12 pairs of rural school districts consolidated. This study estimated the possible cost efficiency of school districts by comparing per pupil spending and revenue data for school districts that consolidated against neighboring districts that did not

consolidate. The spending categories compared were: operating, capital, instructional, administrative and transportation.

A U-shaped relationship was found for the cost categories of operating costs, instructional costs and transportation services. The cost minimizing enrollment was about 4,700 for operating costs, about 3,200 for instructional costs and about 11,500 for transportation services. Capital spending also showed a U-shaped pattern with cost minimizing enrollment of about 750 students. Only administrative costs showed a steady decline as enrollment increased.

In New York rural schools, researchers estimated that consolidation is likely to cut the cost of two 300-pupil districts by over 20 percent, cut the costs of two 900-pupil districts by 7 to 9 percent and have little if any net impact on the costs of two 1,500-pupil districts.

The results indicated that there were some short-run adjustment costs associated with consolidation, but that these costs phase out over time. Duncombe and Yinger concluded that consolidation is likely to cut the costs of two 300-pupil districts by over 20 percent, cut the costs of two 900-pupil districts by 7 to 9 percent and have little if any net impact on the costs of two 1,500-pupil districts.

Trostel & Reilly (2005)

A two-part study by Trostel & Reilly (2005) found that consolidation of school districts in Maine would result in cost savings and that if socio-economic factors were taken into account, there was no relationship between school district size and educational outcomes in Maine (to be discussed further later in this report). Maine's number of students per school district is 45th in the country. The state's education system is also somewhat costly compared to the rest of the country. The study examined enrollment[4] and cost data for the years 1998-1999 through 2002-2003 and estimated cost savings if school districts had more cost-effective enrollment sizes.

When per pupil costs were compared with school district enrollment, a U-shaped pattern emerged. In general districts with enrollments below 500 students had higher costs with the highest costs per pupil in districts with enrollments of fewer than 100 students. Portland, Maine's largest district with 7,304 students also had higher costs than the median size district for the state and indicated higher per pupil costs at the upper end of the cost per district size scale.

When estimating the ideal size for cost savings for school districts in Maine, this study focused on the number of students per grade level in a district. Per pupil costs for school districts declined up to an enrollment level of 574 per grade for districts with a high school and up to 149 students per grade

[4]Troestel & Reilly used enrolled students as opposed to resident student data. 60 percent of Maine's school districts tuition at least some of their students to other school districts. Maine had 60 school districts that did not operate schools and tuitioned all the students to other districts.

for districts without a high school. However, once per grade enrollment reached 400 students for districts with high schools or 120 for districts without a high school the cost savings were not significant.

Immerman & Otto (2003)

Immerman & Otto prepared a study on expenditures with respect to school district size in Iowa (2003). Using data from the 2000-2001 school year, they found that per pupil expenses rise as enrollment falls below about 750 students, but for enrollment above 1,000 students, per pupil expenses are relatively constant indicating that economies of scale exist in Iowa school districts.

This simple study examined school district expenditures by plotting them against enrollment levels. The study did not attempt to control for factors that could affect school district costs or efficiency. These plots indicated that a reciprocal relationship exists between expenses with respect to district size. This relationship was most noticeable in regard to instruction and administration expenses, which account for nearly 80 percent of the average district spending. Forty percent of the variation in per pupil district expenses was credited to the relationship between district enrollment and total expenses.

Heinz (1993)

Another simple study was performed in Minnesota by examining costs per pupil in relation to school district size categories (Hinz, 1993). This study examined data from the Minnesota Department of Education for the 1992 school year.

School district expenses differed greatly by district in Minnesota, but the highest per pupil expenditures were in the smallest and largest districts. The smaller districts costs were higher for what the author termed fixed costs (administration, instructor salaries and transportation costs) because these were spread over fewer students and larger geographic areas than in large districts. Larger districts had higher costs for exceptional instruction and support services for at-risk and gifted students.

Boex & Martinez-Vasquez (1993)

In a study of Georgia school districts, Boex and Martinez-Vasquez (1998) focused on economies of scale and other factors that may affect the decision of school districts to consolidate. They found that potential cost savings from economies of scale do exist although they are small for most school districts.

A simple study in Iowa found that per pupil expenses rise as enrollment falls below about 750 students, but for enrollment above 1,000 students per pupil expenses are relatively constant.

Using variable costs[5] like instructional expenses, administrative costs, and spending on teacher and student support services, cost functions were estimated for 1977 and for 1987. Variable costs per student were found to decrease as enrollment in high schools increased. However, this was not the case at the elementary and middle school grade levels.

The estimated cost savings for a ten percent increase in high school enrollment was about 7 dollars per student. However, some small independent school districts could realize significant savings, up to $316 per pupil, by consolidating with a neighboring county school district that was much larger than the small district.

A study of rural Pennsylvania school districts found that small districts spent about $100 more per student than larger districts, but this difference was not statistically significant.

Gong (2005)

Yi Gong focused on the relationship between school district size and per pupil costs in rural Pennsylvania in his comprehensive doctoral dissertation. Gong found that big rural school district expenditures did not differ much in per pupil expenditure from small rural school districts. Small districts spent about $100 per student more than larger districts but this difference was not statistically significant.

[5] These are defined as expenses that can vary on a yearly basis.

Student Achievement Studies

As school districts become larger, student achievement does not necessarily increase, and in fact may decrease. However, these differences are usually not significant when single-level regression techniques are used to examine the relationship between school district size and student performance.

When multilevel approaches are employed, the size of a school district is often shown to be related to student achievement, especially when student socioeconomic status (SES) is taken into account. Poorer students have lower achievement levels in larger school districts. In some cases, the converse is true; more affluent students may perform better in larger school districts.

Many recent studies have examined the interaction between school district size, student achievement and socioeconomic status (SES). Student SES levels are most often determined by looking at the number of students who are eligible for free or reduced price lunches.

Following are studies that have focused on student achievement in relation to school district size and their findings:

- School district size does not have a significant direct relationship and indirectly has a very slight effect on student achievement in Colorado (Bidwell and Kasarda, 1975).

- There is a negative relationship between SES and student achievement. Small school districts help low SES students break this relationship, while large districts help high-SES student achievement in Arkansas, California, Nebraska, West Virginia, Georgia, Montana, Nebraska, Ohio, Texas, Utah and Washington (Friedkin & Necochea, 1988; Howley, 1995; Howley & Bickel, 1999; Bickel & Howley, 2000; Abbott, Joireman & Stroh, 2002; Cox, 2002; Johnson, 2002; Johnson, Howley & Howley, 2002).

- In New York and a rural region of Texas student achievement was higher in larger school districts (Duncombe, et al., 1994; Hewitt, 2002).

- In South Carolina the size of a school district had no impact on student achievement at the elementary level, although low SES middle and high school students performed better in smaller school districts (Miley & Associates, Inc. 2003).

Bidwell & Kasarda (1975)

An early look at the effects of school district size on student achievement was made by Bidwell and Kasarda in 1975. They examined the effects of a number of environmental factors on school structure and student achievement. They found no direct effect of school district size on the student achievement levels. They also found that school district size had opposing indirect effects on student achievement.

A study in Colorado found that increasing district size improved achievement by decreasing administrative intensity and raising staff qualification, but larger districts also lowered achievement levels by increasing pupil-teacher ratios.

The study used regression analysis on data from 104 school districts in Colorado in looking at the relationship between environmental conditions, organizational attributes and achievement levels. Environmental conditions were defined as: school district size, fiscal resources, disadvantaged students, education of parents and percent non-white. Organizational attributes were pupil-teacher ratio, administrative intensity (ratio of administrators to classroom teachers), professional support and certificated staff qualifications. Achievement was determined by examining standardized test scores in reading and mathematics.

Findings indicated that the number of administrators per student decreased as district size increased. The pupil/teacher ratio increased with as district sizes increased. Teaching staff were more qualified in larger districts. In effect, increasing district size improved achievement by decreasing administrative intensity and raising staff qualification, but larger districts also lowered achievement levels by increasing pupil-teacher ratios.

Although Bidwell and Kasarda did not find an overall direct effect of district size on student achievement, this may be due to the exclusion from their analysis of some of Colorado's school districts (Howley, 2000).

Friedkin & Necochea (1988)

Early studies came to various conclusions on the effects of school district size on student achievement showing that an increase in school district size positively affected achievement, negatively effected achievement or, as in the Bidwell and Kasarda study, had no effect on student achievement.

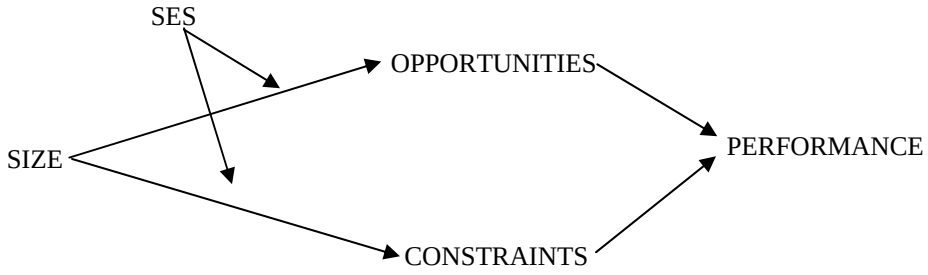
Friedkin & Necochea (1988) attempted to reconcile these conclusions by looking at the effects of SES and school district size on student achievement. They pioneered the use of a

multivariate regression method to analyze the student enrollment levels, school district size and student performance data from the California Department of Education (California Assessment Program) for the 1983-1984 school year. Their research showed that district size had a strong negative effect on performance in low SES school districts, but that this negative effect was eliminated in high SES districts.

The researchers analyzed the relationship between system size and student achievement and found the correlation was weak for all grade levels, although positive at the 12th grade level. This showed that school district size had a slightly negative influence on performance at higher grade levels.

When researchers controlled for SES, the interaction between size and student performance was very different. The effect of size was negative. However, they also found that as a school system became more affluent, the association between the size of a school district and the performance of students went from negative to positive. The negative relationship between size and achievement in low SES school districts was much stronger than the positive relationship between size and achievement in more affluent school districts.

Figure 2. A contingency model of the size-performance relationship



(source: Friedkin and Necochea, 1998)

For whosoever hath, to him shall be given, and he shall have more abundance: but whosoever hath not, from him shall be taken away even that he hath. (Matthew, 13:12)

Matthew Project: Predecessor and Progeny

Howley (1995)

Craig Howley first referenced the Matthew Principle in his 1995 report of his doctoral research. Using data from West Virginia, Howley (1995) performed the first replication of the Friedkin & Necochea study. He looked at both schools and school districts. He found an indirect association of school and district size and achievement in relation to SES. Small schools and districts improved the achievement of low SES.

Bickel & Howley (1999)

In the Matthew Project, Howley and Bickel (1999) again replicated the Friedkin & Necochea multivariate regression analysis of the effects of SES and size on student achievement. In the studies funded by the Rural School and Community Trust, they chose four very different states: Ohio, Georgia, Texas and Montana. These studies indicated that there was a strong negative interaction effect of *school* size on student achievement. However, the researchers found a strong interaction effect between *district* size and achievement for only one of the states—Ohio.

The researchers also examined what they termed the equity effects of size. They tested this effect by determining the correlation between SES and achievement in a group of larger and a group of smaller schools and districts. They found that lower SES students performed better than predicted based on SES in both the group of smaller schools and smaller districts.

Johnson (2002)

Jerry Johnson, a policy analyst with the Rural School and Community Trust examined enrollment and school district size data in Nebraska. Johnson found "some evidence" that school system affects student achievement based on SES. This relationship was statistically significant in three of six achievement measures.

Johnson, Howley & Howley (2002)

Johnson, et al. (2002) examined data from Arkansas school districts. Researchers used test scores from standardized tests administered to students in grades four, five, seven, eight and ten during the 1999-2000 school year. The researchers found that the relationship between district size and achievement was generally negative, except that the relationship was positive in the most affluent districts.

Bickel & Howley (2000)

In trying to determine why district size did not affect student achievement in the Matthew Project studies, Bickel and Howley (2000) again looked at Georgia schools. This time they investigated the joint influence of school size and district size on achievement.

An initial conclusion of the researchers was that the effects of size on achievement depend on multiple influences, not just SES. Specifically, in regard to SES, the researchers found a statistically significant interaction between district size and school SES on achievement. This effect was much greater among eighth grade students than eleventh grade students.

Abbott, Joireman & Stroh (2002)

Abbott et al., replicated the Bickel & Howley (2000) study in Washington. The study examined the joint relationships and cross-level interactions of school and district size on school academic performance.

The researchers' findings were similar to the Bickel and Howley findings for the eighth grade, i.e. school poverty and district size showed a significant interaction. Consistent with the earlier study, the researchers believed that the effects of size are complex. They concluded, "[T]he multi-level findings of our study argue against the simplistic conclusion that reducing school and/or district size will automatically improve student achievement, or be more equitable."

Duncombe et al. (1994)

Duncombe et al. (1994) found that students in larger school districts in New York generally performed better on the state's Regents Examination. Smaller school districts offered fewer preparatory classes for the exam. Performance on the regents test was highest in districts with enrollments between 1,000 and 5,000 students.

Cox (2002)

Cox (2002) studied school district size in relation to student performance in Utah. He found that smaller school districts showed higher achievement levels when they were adjusted to reflect SES status of their communities.

Cox looked at standardized test scores for grade 5, 8 and 11 students in relation to an expected test score range for the SES of their communities. Achievement for grade 11 students fell within their expected ranges irrespective of school district size. For students in grades 5 and 8, however, smaller school districts performed higher in their SES range. As the size of school districts in relation to SES decreased, student achievement within the expected ranges increased.

Researchers in Washington concluded that the multilevel findings of their study argue against the simplistic conclusion that reducing school and/or district size will automatically improve student achievement, or be more equitable.

Hewitt (2002)

Hewitt (2002) performed a limited study in Texas to determine if there was a relationship between school district size and academic achievement.

This study focused on data from 72 school districts in a rural region of Texas and used standardized test scores for 3rd graders as a measure of achievement. Students from very small school districts (fewer than 500 students) did not exhibit higher achievement than students in larger school districts within the region.

In South Carolina, smaller districts were more effective in promoting achievement for low SES students, while larger districts were more effective in promoting achievement for high SES students.

Miley & Associates (2002)

In the second part of a study by Miley & Associates, Inc. (2003), the researchers found that the impact of school or district size on student achievement levels depended on the SES of the students being served.

Data on enrollment, SES and student achievement test results for students at all levels of schooling during the 2000-2001 school year were used in this study. No significant relationship was found at the elementary school level. However, for middle and high schools, low SES students tended to have higher achievement levels in smaller districts.

School district size was also found to have an impact in relation to school size. Lower SES students in smaller schools performed better in smaller districts although larger districts generated higher achievement levels for schools with more affluent students. The researchers concluded that the hypothesis generated from the literature that smaller scale tends to be more effective in promoting student achievement for low SES student populations while large scale is better for higher income populations was generally confirmed for middle and high schools in South Carolina.

Gong (2005)

A 2005 study attempted to eliminate urban and rural effects by examining large and small rural school districts in Pennsylvania (Gong 2005). The study looked at the size effects of school districts on fiscal management, administrative leadership and student achievement. The dividing line between the two categories was 2,500 students.

Gong made comparisons on forty-two different factors related to management, administration and student achievement. He found that a number of differences were statistically significant between large and small districts, but he also found that that the districts differed on the percentage of low-income students and non-White students. Controlling for these variables, most of the differences disappeared.

Although the study found that small districts spent about

$100 per student more than larger districts, this difference was not statistically significant. However, larger districts spent a higher percentage of their monies on instruction. The major differences in curriculum were in high school. The larger districts offered more art and music programs, acceleration programs, foreign language courses, tech prep programs and honors programs.

Big district students out performed those from small districts in most of the student achievement measures. Achievement was measured in terms of student achievement tests, ACT and SAT scores, student engagement and dropout rates. However, similar to the other findings, much of this difference was explained by differences in student background.

Gong found that program availability was also a significant predictor of student achievement. He concluded that consolidation is beneficial only if, on consolidation, the district provides a wider curriculum.

Efficiency Studies

A few of the studies reviewed focused on the efficiency of school districts in increasing student learning. Results of these studies were mixed. A New Jersey study found that smaller school districts were more efficient in providing a quality education (Walberg, 1987). Studies examining school district efficiency in Arkansas found that school districts of various sizes were efficient. However, many of the smallest school districts were not found to be efficient because of their per pupil costs in the areas of administration and operations and maintenance (Hughes & Metzger, 2003; Rainey & Murova, 2003).

Walberg (1987)

Walberg (1987) focused his study on student achievement in relation to the district characteristics of size, expenditures and student SES. He found that higher costs were associated with lower student achievement once district SES and enrollment levels were factored.

Data from the New Jersey Department of Education on achievement test scores, per pupil costs, district enrollment size and SES characteristics of public school districts were analyzed. Both standardized tests and high school proficiency tests were used to determine achievement levels. Three types of expenditures were analyzed: day school expenses, total expenses and current budgets. Average daily enrollment levels varied from 36 to 56,294 students. SES was determined using the New Jersey index which was an "[u]nusually comprehensive index and optimally weighted composite of a range of income, unemployment, poverty, and both household and urban density indicators." (page 9).

Walberg concluded that average student test scores on state-developed and national achievement tests in New Jersey school districts were closely and significantly associated with the SES of the districts. Higher SES districts had generally (or on average) higher scores; lower SES districts had generally lower scores. Per-student financial expenditures on education were insignificantly or inconsistently associated with achievement test scores. Low spending districts on average achieved as well as high spending districts of the same SES. His final finding was that larger New Jersey districts achieved less efficiently than smaller districts in the state.

When looking at school district size, larger districts were associated with lower student achievement. Controlling for SES, districts with up to 2,600 students performed best and districts with more than 7,150

A New Jersey study concluded that larger school districts performed less efficiently than smaller districts.

students performed the worst. Generally, large school districts were less efficient increasing student achievement when SES and expenditures were factored in.

Hughes& Metzger (2003)

Two studies analyzed data in Arkansas to determine the most efficient overall enrollment size for school districts (Hughes & Metzger, 2003; Rainey & Murova, 2003).

The studies used data from 310 Arkansas school districts for the 2000-01 school year. To determine efficiency they created 28 indicators of efficiency using information on school district revenues and expenditures, achievement, enrollment, administration and student SES. This data was grouped to determine efficiency levels in the following categories: fiscal efficiency, academic achievement efficiency, size efficiency and administrative efficiency. It must be noted that per pupil costs in these studies were used as *one* of the indicators of efficiency, but not as *the* indicator of efficiency.

In Arkansas the average student enrollment for the efficient districts was 3,264 students, with efficient district sizes ranging from 600 to 12,000.

Hughes & Metzger identified 48 school districts as the most efficient. These efficient districts had on average the highest student achievement, the highest teacher salaries and some of the lowest costs per pupil for administration and operations and maintenance. The average cost per pupil was about $225 less for the most efficient districts than the state average. The average student enrollment for the efficient districts was 3,264 students, with efficient district sizes ranging from 600 to 12,000 students.

Rainey & Murova (2003)

Efficient districts were found at all levels of enrollment. However, a disproportionate number of the districts with enrollment less than 1,000 were classified as inefficient (118 of 135 inefficient districts). All fourteen of the school districts with enrollments of less than 900 students were in the lowest efficiency category.

One caveat with these findings is that the researchers did not control for SES.

For their study, Rainey & Murova (2003) divided the school districts used in the Hughes & Metzger study into three size categories: enrollment of up to 500 students, enrollment between 500 and 1,250 students and enrollment of 1,250 or more.

Efficiency within these categories varied and depended on how the use of resources affected student performance. The researchers noted that their findings support two important hypotheses:

1. Small school districts have a harder time maintaining efficiency, primarily because they have fewer students to help cover fixed costs and overhead expenses.

2. There were economies of scale in medium-large school districts in terms of resources and fiscal efficiency.

School Choice Studies

In the past two decades increasing attention has been given to greater choice in schooling in the belief that competition encourages organizations to perform at their best. If school districts must compete with each other for students, the existence of high-performing neighboring districts may put pressure on school administrators to improve efficiency by increasing student achievement and lowering costs in their own district. School districts that are very large in terms of enrollment or geographic size may suffer from a lack of competition and become less efficient.

Several mechanisms have provided for increased school choice, including private schools, charter schools and voucher programs. Choice is also made the old fashioned way—by families moving close to the school or within the school district believed to best meet the familys' needs.

Much of the theory of traditional school choice is based on the more general Tiebout model. Under this model, consumers are assumed to vote with their feet by moving to the community that provides the most preferred public good/tax package. The assumptions underlying this model include:

1. Individuals have perfect information about the differences in services/tax packages that exist among the communities.
2. Mobility is costless.
3. There are enough communities so that an individual can reside in a community that exactly satisfies their desires.
4. Public goods are financed through lump sum taxes.

The following studies examine the affects of this theory on school performance and governance.

<u>Hoxby (2000)</u>

Hoxby (2000) examined the affects of school choice on student achievement in metropolitan areas. She looked at school choice at the district level instead of the school level, because districts have financial autonomy and not schools. She theorized that incentives for productivity depend on financial consequences, so these incentives would be felt at the district level not the school level.

Hoxby used several indices of the degree of choice in a district based on the number of

The Tiebout model theorizes that consumers are assumed to vote with their feet by moving to the community that provides the most preferred public good/tax package

districts per student in the metropolitan area, the school district's share of land area or the district's share of total enrollment. Comparing these indices to a number of achievement and cost measures, Hoxby concluded that Tiebout choice raises productivity by simultaneously raising achievement and lowering spending.

The study provides conflicting evidence of whether choice is made at the district or school level, however. The researcher distinguished between Tiebout choice and student sorting. She measured relative heterogeneity in schools based on race and SES. Hoxby found that the heterogeneity of students' peers was related to the number of schools as opposed to the number of districts in a metropolitan area. The more schools there were in an area, the more homogeneous were a student's peers based on race and SES. Hoxby stated that households sort themselves into school attendance areas regardless whether they have much choice among districts. Therefore, the effect of choice on productivity is more likely to be caused by competitive pressure among districts than by student sorting.

A nationwide study concluded that Tiebout choice raises productivity by simultaneously raising achievement and lowering spending.

It seems more plausible that what Hoxby terms "sorting" is actually choice made at the school level. One of the tenets of the Tiebout model is that communities will become more homogenous as they sort based on common views on the service/tax package. Hoxby provides evidence of homogeneity at the school level, which indicates that this is the level at which choice is made. Another alternative explanation is that the nature of this dependent variable, race or SES, promotes homogeneity regardless of the school or district choice available. Neither of the alternative views support the idea that school choice is made at the district level.

Green & Winters (2005)

Green & Winters (2005) examined the impact of school district size in terms of geographic area on student graduation rates. They concluded that decreasing the size of school districts would result in increased graduation rates.

This study looked at graduation rates in relation to the average school district size (measured in square miles) for each state. They found a statistically significant relationship between changes in the average size of a state's school districts and high school graduation rates. Decreasing the average size of a state's school districts by 200 square miles would increase the graduation rate by 1.7 percent.

In determining graduation rates the researchers considered general population changes but did not specifically consider the number of students in each grade

that moved in or out of the state. The study did not control for any other influence on graduation rates. Also the researchers attributed to the district size change the full effect of the graduation rate change.

Millimet & Rangaprasad (2005)

The authors noted that the results of studies on school competition were inconsistent. Hoxby and others had indicated that increased competition improved achievement and teacher quality and reduced per pupil costs. See Hoxby (2000) and Hanushek & Rivikin (2003). One study found that increased competition had no effect after a certain threshold is reached (three to four districts per county) (Zanzig, 1997). Other researchers had found no impact or a negative impact of competition (Brasington, 2002).

Millimet and Rangaprasad believed that because of competition, school governing boards react to actions taken in neighboring districts. The researchers examined data concerning school districts in Illinois for the period 1990-2000. A unique feature of Illinois school finance is that some school districts are subject to limits on increases in total property tax, while others have no cap.

The researchers found some evidence that districts do consider the actions of neighboring districts in determining pupil-teacher ratio, teacher salaries and school size. However, this finding depended on whether the district was subject to the tax limits. Districts that were not subject to the limits made policy decisions without regard to the decisions of nearby districts. The authors concluded that the findings provided support for the claim that competition can alter the behavior of school administrators, but competition alone is insufficient to alter the quality of public schools.

In Illinois, school district governing boards considered actions of neighboring districts in making strategic decisions, but only if the district was subject to taxation limitation.

Reform Study

The size of a school district can affect more than its per pupil costs and student achievement. Hannaway & Kimball (1998) performed an unusual study that measured the effects of enrollment size in relation to a school district's ability to implement reform. They found that larger districts were better able to implement reform measures.

Researchers used 1996 data from a random sample of 2,700 nationally representative school districts, not including districts with enrollment of less than 300 students. Districts indicated their progress on implementing various measures of reform by responding to a survey. The authors noted that they had no measures of *actual* progress in school districts since survey data consisted only of *reports* of progress. Reports of progress were used together with data from a similar survey sent to schools and data on school district size and poverty level.

The districts were divided into four enrollment size categories: 300 to 2,500 students, 2,501 to 10,000 students, 10,001 to 25,000 students and more than 25,000 students. Hannaway & Kimball found that, although most districts reported progress in standards-based reform, districts with enrollments between 300 and 2,500 were least likely to show high levels of progress for any reform areas. As district size increased, so did the reports on progress in reform areas.

Poverty levels were also found to affect the ability of districts to implement reform. Low poverty districts reported more progress than high-poverty districts. Results also suggested that high-poverty districts may benefit less from large size in making reform progress.

The authors concluded that larger districts appear to be better able to promote or facilitate reform than smaller districts. This difference arose because larger districts have greater specialized areas of expertise, such as dedicated units for assessment and professional development, slack resources available to direct to reform due to economies of scale and better access to technical assistance.

Conclusions

An initial review of the study results might imply that support exists for just about any theory proposed related to school district size and its effects on efficiency and student achievement. However, some findings are consistent among most of the relevant studies.

Significant support exists for the finding that economies of scale exist for increasing school district size. As school districts increase in size per pupil expenditures decrease. The greatest efficiency gains would be made by combining the smallest school districts, unless consolidation requires substantially increased transportation costs. The greatest savings from consolidation appear to arise in reduction of administrative costs.

There is also evidence that diseconomies of scale exist when a district becomes large. However, there is no agreement on how large a district has to be for these diseconomies to manifest themselves.

Some of the studies have found a negative relationship between school district size and student achievement for low SES students and a positive relationship for high SES students. Low SES students perform better in smaller districts than in larger districts. High SES students perform better in larger districts. However, not all the studies found this relationship. Also, the studies that that examined this relationship further by looking at school-school district interactions and their effect on achievement concluded that the effects of size are a complex matter. Size needs to be viewed in the context of other influences to determine its effect on student achievement.

An increase in competition to some threshold level appears to improve efficiency and student achievement. However, it is not clear whether school choice is made at the district or school level. Therefore, the Tiebout choice research does not necessarily support increasing the number of school districts.

Finally, while the studies indicated trends depending on whether a district was large or small, there was no agreement on specific enrollment levels at which these changes occur. What is large or small depends on the context in which the question is asked.

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