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ABSTRACT

This report examines school district size and organization in South Carolina and their impact on student achievement and fiscal efficiency. A brief overview discusses the history of school district organization since the Civil War, the current distribution of districts across size categories in South Carolina and the nation, variations in school district governance, and the allowable methods for altering district boundaries. A review of over 60 studies of school district size suggests that smaller districts may promote student achievement while larger districts produce cost savings. The best size for efficiency may not be best for student performance. A detailed geographic description of South Carolina districts includes maps and data on racial composition, income, population density, age and sex composition, property tax base, and student achievement. Regression analyses of the impact of district size on student performance and fiscal efficiency used data from all public schools: 184 high schools, 268 middle schools, and 611 elementary schools. District size did not appear to affect achievement in elementary schools. Smaller districts promoted achievement for middle-school and high school student populations with lower socioeconomic status, while larger districts were better for higher-income populations. The non-teaching cost per student tended to decline as district size increased, although savings disappeared in the largest districts. Recommendations focus on avoiding a "one-size-fits-all" approach, given the great diversity of districts, and on providing more resources to poor and rural districts with low tax bases. Appendices contains expenditure data by district, a 61-item bibliography, and additional maps. (SV)

School District Organization in South Carolina:

Evaluating Performance and Fiscal Efficiency

Prepared
for

The Education Oversight Committee

Prepared by

Miley & Associates, Inc.
Columbia, South Carolina

January 16, 2003

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1. Introduction

In the winter of 2001 the Education Oversight Committee (EOC) adopted fourteen recommendations regarding educational governance to the General Assembly for consideration. The last recommendation "The Education Oversight Committee shall contract with an independent party to study school district organization in order to improve fiscal economies while promoting high achievement. The report of the study shall be available by January 2003".

To address this issue the EOC retained a group of outside experts as opposed to hiring a single firm. In September 2001, the EOC selected a team of consultants led by Miley & Associates, Inc. to undertake a research project. The EOC staff assisted the team by providing research and logistical support. This arrangement provided a high quality product while significantly lowering the costs of the research project.

The team included the following members:

David Cowen, Ph. D., Professor and Chair of the University of South Carolina Department of Geography
Phil Kelly, Ph.D., Education Finance Consultant, and former Associate Superintendent of York School District Three
Randolph C. Martin, Ph.D., Professor and Chair of the Economics Department, Moore School of Business, University of South Carolina
Harry W. Miley, Jr., Ph.D., President, Miley and Associates, Inc.

In addition to the research team, the EOC created an advisory board to provide advice and council throughout the project. The Advisory Board met three times during the study and provided many useful recommendations. The Board was comprised of legislators, business leaders and educators (See Appendix 1 for membership).

The recommendation by the full EOC in early 2001 established three critical elements for the scope of such a study. These included;

(1) The study should focus on districts, rather that schools;
(2) The study should address the potential for improvement of fiscal economies;
(3) The study should focus on the promotion of high achievement.

This report details the results of the team's analysis. The report is divided into the following sections:

Section 2 Historical Overview

This section provides a brief overview of the current configuration of public school districts in South Carolina and how it came into being. South Carolina's experience is compared to that of other states and the nation in terms of school governance and school district delineation.

Section 3 Literature Review

This section provides an extensive overview of the existing literature on the relationship between school district size and student performance and district size and fiscal efficiency.

Section 4 A GIS Description of South Carolina' School Districts

Section 4 provides a detailed, geographic description of the state's school districts. This section of the report includes maps and detailed data on a wide variety of demographic and economic variables for each school district. This overview includes data on racial composition; economic status (income and income distribution); population and population densities; age/sex composition; and various public sector variables (e.g. property tax base). These descriptors are then combined with various measures of student achievement (PAC scores) and cost variables.

Section 5 School District Size And Student Achievement

Many factors are known to influence the levels of academic performance. The purpose of this section is to examine the extent that school district boundaries may influence a child's educational performance. This section includes a statistical examination of the data on South Carolina districts that identifies the influence of district size on student performance, controlling for other contributing factors.

Section 6 Organizational Scale and Fiscal Efficiencies

Section 6 provides the results of analyses of the relationship between organizational scale (district size) and operating efficiencies (per student cost). Actual fiscal data for the districts are analyzed to determine the cost effectiveness of the operation of South Carolina school districts. The In$ite cost categories developed by Coopers and Lybrand are utilized for this analysis.

Section 7 Summary and Recommendations

This section provides a summary of the research and recommendations for consideration by the EOC.

2. Historical Review of South Carolina Public Education

The history of public education in South Carolina is not unlike the history of many southern states. Soon after the first permanent English settlements were established in 1670, the educational needs of the masses were addressed by the church. These efforts were for the benefit of orphans and the poor. For those of means the acceptable form of education was by private tuition. In the Acts of 1710 and 1712 the first efforts of public education can be found in the state with the establishment of free schools in South Carolina.

The initial school was located in Charleston with support from donations. Over the next one hundred years little progress was made in public education. The free school concept did not flourish since they were viewed as the school for paupers.[1] The majority of the populace was educated in the church schools or at the various academies, which opened in response to those desiring private instruction.

The first state support for the free schools can be traced to "An Act to Establish Free Schools throughout the State," which was adopted by the legislature in 1811. The act stipulated each election district would have a school supported with an annual appropriation of $300 and preference given to indigent whites. These schools showed little progress over the next thirty years. The reason for the lack of support can be summarized in the following by John Furman Thomason: "The aristocratic idea thus gained strength and solidarity and the dominant opinion in the State pertaining to education was that there was no need for public education as contemplated by the American school system, but that private instruction could be relied upon to perform the major part of the work of education. The only need was to do something for the poor." [2]

This attitude prevailed until the middle of the century when urging by state leaders and national success of public schools lead to a change in the acceptance of the free schools. By the outbreak of the Civil War attendance in schools had increased to 20,000 with annual support of $200,000.[3] The State maintained the system of public free schools until the demands of the war effort caused their collapse.

1 Colyer Meriweather, History of Higher Education in South Carolina, p 38.
2 John Furman Thomason, Foundation of Public Schools of South Carolina, p 173.
3 Henry T. Thompson, The Establishment of Public School System of South Carolina, p 7.

During the Reconstruction period following the Civil War, the Constitution of 1868 was adopted. While universal free education was a major component in the new Constitution, it was not until some time later that the public education system we know today emerged. The new law did establish the office of State Superintendent of Education and provided for elected County School Commissioners. It stipulated the State be divided into school districts with compulsory attendance for children age's six to eleven which compares to our current age standard of 17. It also provided for revenue from state appropriations, a poll tax and local taxes levied by elections in which non-property owners participated. [4] Despite this attention to the free schools the system was viewed as an absolute failure. [5]

It was not until the restoration of home rule in 1877 that public education began to be accepted by the total population of the state. The election of Hugh Thompson as State Superintendent of Education and his pressing for new educational laws, adopted in 1878, was a major reason for the change in attitude. [6]

Since that time many changes have occurred impacting public education, but the concept of a universal free education system has remained firm albeit separate systems for the races until recent times. The organizational structure of public schools has changed but the framework established in the 1878 has remained. The 1895 Constitution contained some changes in the structure of public education, but the basic system established in the 1868 Constitution remained intact. From this beginning we can trace the evolution of public education in the state. Each county maintained a county board of education which exercised various degrees of control over the ever-increasing number of school districts which sprang up in each county as communities became incorporated. This trend continued until the early 1950's when a move toward the consolidation of school districts occurred. The following chart illustrates the changes over the last few decades in the number of school districts.

Table 1
Changes in Number of School Districts

Year	No. Districts	Largest ADM	Smallest ADM	Average ADM	Ave. Exp. Per Pupil	Highest Exp. Per Pupil	Lowest Exp. Per Pupil
1950	1,220	36,578	2,398	10,937	$117	$151	$80
1960	108	42,489	371	4,920	$179	$261	$121
1970	95	53,174	442	6,319	$508	$629	$366
1980	92	52,042	525	6,596	$1,381	$1,812	$1,042
1990	91	50,620	576	6,757	$3,788	$5,045	$3,187
2000	86	58,019	443	7,539			

Source: State Superintendents Annual Report

4 Thompson, p 11
5 R Means Davis, A Sketch of Education in South Carolina, p 435.
6 A.R. Banks, Historical Sketch f Education in South Carolina, p 169..

The figures for 1950 are not comparable with the figures for the remaining years since all data was reported on a county base rather than district base. This year was included in the table to illustrate the status in the state that existed prior to the large-scale consolidation move in the early part of the 1950's. Following the massive consolidation a fairly long period of stability in the organizational structure of school districts existed in the state.

The changes which occurred most recently have taken place in Orangeburg County and Marion County. In Orangeburg County there was a consolidation of eight districts, the largest number of school districts in any county, to the current number of three. The consolidation in Marion County became effective in 2002 with the consolidation of the two smallest districts in the state. The consolidated district, Marion 7, has a pupil population of 1,058.

One factor occurring during the period, which is not reflected on the chart, is the gradual elimination of County Boards of Education in multi-district counties. These Boards which initially existed in all counties over time took on different roles in multi-district counties versus countywide units. In the countywide districts the county board of trustees was the operating board, while in multi-district counties the authority of the boards varied by county. The most common authority exercised by the boards in multi-district counties was that of approving budgets and setting the local supplement for teacher salaries. Today only two multi-district counties have operating County Boards of Trustees. [7]

A. Comparison of South Carolina School Districts

In school year 2001-02 the number of school districts in the state has been reduced to 85 with the consolidation of the prior two smallest districts in the state, Marion 3 and 4 into the consolidated Marion 7. Of the 85 school districts 29 are countywide units with an average size of 11,659 pupils. The remaining 56 districts are located in 17 counties with an average size of 5,540. The average number of districts in the multi-district counties is three with the largest number being seven in Spartanburg County.

The school districts range in size from 58,019 to 912 with an average size of 7,627 and median of 4,287. The standard deviation in district size is 9,041 which is fairly large compared to the average district size of 7,627 students. The largest district represents 8.9 percent of the state's student population while the smallest district has 0.1 percent of the students. The 10 largest districts contain 269,922 pupils or 41.6 percent of the state's students while the 10 smallest have 10,936 students for 1.7 percent of the total. The following chart illustrates the number of districts in each size range.

7 Online, South Carolina School Boards Association, scsba.com.

Table 2

Number of Districts by Size Range and Population in Range

District size	Number districts	Percent Of districts	Percent of students
State	85	100.0	100.0
25,000 or more	5	5.9	27.8
10,000 –24,999	13	15.3	29.4
7,500 -9,999	12	14.1	16.2
5,000 – 7,499	9	10.6	8.3
2,500 – 4,999	23	27.0	12.8
1,500 – 2,499	9	10.6	2.9
1 – 1,499	14	16.5	2.6

Source: Rankings, South Carolina State Department of Education, 1999-2000.

This table clearly demonstrates that the majority of the state's students are being educated in a fairly small number of districts with over half the population residing in 18 districts. The remaining 67 districts educate 43 percent of the state's student population.

When this same information in compiled on a county base rather than a school district base the range in size becomes 58,019 for the largest and 1,187 for the smallest which is not a great reduction from the statistics by district. However, the average size increases to 14,095, which is almost double the district average, and the median increases to 8,990. While the standard deviation increases to 13,509, it does indicate less variation in the size of the student populations being served on a county base rather than a district base. The 10 largest county units provided educational services to 362,314 students or 55.9 percent of the total statewide count while the 10 smallest county units provided services to 29,531 students or 4.6 percent of the total population. Table 3 shows the number of counties by size range.

Table 3

Number of Counties by Size Range and Population in Range

County size	Number counties	Percent Of counties	Percent of students
State	46	100.0	100.0
25,000 or more	9	19.6	52.2
10,000 – 24,999	11	23.9	26.8
7,500 – 9,999	5	10.9	7.0
5,000 – 7,499	8	17.4	7.6
2,500 –4,999	9	19.6	5.3
1,500 – 2,499	3	6.5	0.9
1 – 1,499	1	2.1	0.2

On a county base the number of districts with less than 5,000 students is 13 with only four counties with less than 2,500 students. This compares to 46 and 23 districts on a district base.

B. Comparison of National School Districts

According to the U.S. Department of Education, National Center for Education Statistics, there are 14,571 regular school districts in the country. While the majority of the districts, 10,572, are regular kindergarten through grade 12 districts many states have separate districts for the various grade spans. The median number of districts for the states is 176 with the largest number in any state being 1,041 in Texas and the smallest number being one in Hawaii. In terms of district size the average is 3,217 students. The following chart gives the distribution of districts by size.

Table 4
Number of Districts

District size	Number districts	Percentage Of districts	Percentage of students
US	14,571	100.0	100.0
25,000 or more	238	1.7	32.1
10,000-24,999	579	4.0	18.7
7,500-9.999	320	2.2	6.0
5,000-7,499	716	4.9	9.4
2,500-4,999	2,068	14.2	15.6
1,500-2,499	1,893	13.0	8.0
1-1,499	8,757	60.0	10.2

Source: US Department of Education, National Center for Educational Statistics, Common Core of Data, 1999-2000.

Nationally, 12.8 percent of the districts provide educational services to 66.3 percent of the students. While only 10.2 of the students are served in the districts with less than 1,499 students which represent 60 percent of the total number of districts. The tables below compare the distribution of districts by size for the US and South Carolina.

Table 5

Comparison of Number of Districts by Size for SC and US

District size	Percentage of districts		Percentage of students	
	US	SC	US	SC
25,000 or more	1.7	5.9	32.1	27.8
10,000-24,999	4.0	15.3	18.7	29.4
7,500-9,999	2.2	14.1	6.0	16.2
5,000-7,499	4.9	10.6	9.4	8.3
2,500-4,999	14.2	27.0	15.6	12.8
1,500-2,499	13.0	10.6	8.0	2.9
1-1,499	60.0	16.5	10.2	2.6

While nationally and in South Carolina the trend is for the majority of the students to be served in relatively few large districts, the South Carolina distribution is not as skewed as the national distribution. South Carolina has considerably fewer districts in the smaller ranks than at the national level. By looking at the states with the large number of small districts, it's more a question of population density than organizational design.

C. South Carolina School District Governance

South Carolina is rather unique in its lack of standard governance legislation. In terms of elections of school boards 77 of the 85 districts have elected school boards. There are seven districts with appointed boards and one with a combination of elected and appointed. The highest membership of board members is 12 which is found in two districts. The fewest membership is five members which is found in 15 districts. The most prevalent configuration is seven members which are found in 42 districts.

One of the most important differences in the governance of school districts in South Carolina is their fiscal authority. There are 23 districts, all with elected boards, with total independence over the budget approval and millage setting. There are 26 districts, 22 with elected boards, which have no fiscal authority. In three of the 26 the budget is approved by the legislative delegation, three have budgets approved at a town meeting and the remaining 20 with no authority must have their budgets approved by county council. There are 33 districts with limited authority. They are limited by some specified yearly increase which is generally a specific millage. To exceed the limit the board must go through another body or referendum. The remaining three districts have a millage cap which can only be exceeded with county council approval in two of the districts and a referendum in the other. [8]

D. Altering School District Boundaries

The statute relating to the alteration of school districts in South Carolina is Section 59-17-20, Code of Laws. The legislation allows for two methods for the alteration of school district boundaries. Section 59-17-20(1) provides for the changes in school district boundaries by Acts of the General Assembly. Section 59-17-20(2) authorizes alteration of school district boundaries by action of the county boards of education under the following conditions:

a. written approval by the Senator and entire house legislative delegation of the county involved; or

b. written petition signed by at least four fifths of the qualified electors within the limits of each of the school districts involved; or

c. written petition signed by at one third of the qualified electors within the limits of each of the school districts involved and a successful election by the qualified electors called on the question by the county board of education.

8 Ibid, scsba.com

3. Literature Review

A. Introduction

The purpose of this section is to examine the literature pertaining to the topic at hand. Specifically, this report is concerned with the relationship between school district size and student performance and district size and fiscal efficiency for South Carolina school districts. The previous section provided an overview of the historical development of school districts in our state. It was observed that dramatic changes occurred in the organization of districts during the 1950s. The number of districts declined from 1,220 in 1950 to 108 by 1960. Average district size increased from 412 students (1950) to 4,920 (1960). By the year 2000, average district size in South Carolina had grown to 7,539 with the largest district having 58,019 students and the smallest only 443 students.

Given the above, it is obvious why policy makers are interested in the impact of district size on various measures of educational effectiveness and efficiency. As average district size increases and given the great variance in district size, questions concerning impact of size on the educational process and costs are bound to occur. Further, the continuing pressure to consolidate smaller districts remains an issue of public debate. It is thus important to examine what other researchers have found concerning the various impacts of school district size. Such a review also provides insight on methodological issues that will help in examining the situation as it pertains to South Carolina.

Appendix B to this report is a bibliography of papers and studies concerning district size, student performance, and fiscal efficiency. It contains over 60 items covering several decades of studies on these issues. While a truly large volume of material exists on issues of student performance and fiscal efficiency, the attempt was made here to focus on how district size impacts on these measures. Thus, the literature sited in Appendix B is quite specific, as a quick review of this material will indicate. The Education Oversight Committee staff supported the study team in pulling together copies of this material. Their assistance was very helpful and certainly facilitated this part of the research effort.

One of the positive outcomes of the literature search was the identification of several survey articles that provide summaries of the research results up to the date of their publication. This of course assists greatly in pulling together the findings, which are relevant to district size impacts. Referring to the bibliography in Appendix B, the survey articles include Carnochan (12), Hobbs (29), Howley (32), and Swanson (50).

The remainder of this section is organized in the following manner. First, the findings of past research on the impact of school district size on student performance are examined. Included is a discussion of how to appropriately represent or measure district size and student performance. This is followed by an examination of what the literature has to say

on the issue of district size and fiscal efficiency. Here the issue of measuring efficiency (costs) is also considered. Finally, the section ends with a set of conclusions and observations concerning the appropriate analytical approach for examining these issues for school districts in South Carolina.

B. School District Size and Student Performance.

The first issue of concern in examining the size-performance issue is what does one mean when talking about school districts of different "size"? In most cases, studies have used some measure of attendance to represent the "size' of a district. For example, Bickel and Howley (7) use "number of students per grade level in thousand of student units..." Friedkin and Necochea (22) represent size by the "number of pupils at a particular grade level in a school or school district". Hinz (27) indicates that "district size refers to an organization of schools from kindergarten through twelfth grade under a single school board and superintendent." She uses the sum of school enrollments. In Hawley (33) "size was defined as enrollment per grade level either by school or district (depending on the unit of analysis)."

Attendance or number of students, however, is not the only possible indicator of district size. Hobbs (29) in his 1989 review of the district size literature refers to an early study[1] that finds that student population density was a major factor in determining optimum school district size. The idea is that in sparsely populated areas districts are limited in expanding size because of diseconomies in transporting students. Another early study[2] estimates that for each hour per day spent bus riding one could expect a reduction in achievement test scores of four points. Thus, it would appear that an appropriate measure of size should include not only number of students but also some incorporation of the geographic "size" of the district.

Another issue of importance is the consideration of the relationship between district size and school size. According to Bickel and Howley (7)[3], because of mixed results and variability in the methods used to study "size issues", size measures were often considered as uninteresting control variables in studies concerned with student performance. Studies were also of the single-level of analysis variety where either school sizes or district size were studied. More appropriate analysis involves a multi-level approach which links the two levels (school and district) together. Examples of this include Gutherie (23) and Bickel and Howley (7). Thus, while the focus of the current *EOC study* is on the impact of school district size on student performance, *the literature suggests that* it is important to also incorporate school size in the analysis.

One final question that must be answered is the measurement of student performance. In the literature listed in Appendix B, most studies are found to use test results on

[1] White, Fred and Luther Tweeten."Optimal School District Size Emphasizing Rural Areas". *American Journal of Agricultural Economics*. February 173. 45-53.
[2] Lu, Yao-chi and Luther Tweeten. "Impact of Bussing on Student Achievement". *Growth and Change*. 4:4 October 1973.
[3] Page 2.

standardized tests, state or district wide exit exams, dropout rates and other similar measures. For example: Amos (2) uses student scores on various components of the California Achievement Test; Bickel and Howley (7) measure performance by school-level percentile rank score from the Iowa Test of Basic Skills and school-level percentage of students passing the first administration of the Georgia High School Graduation Test; Friedkin and Necochea (22) incorporate the mean values from the California Assessment Program with includes a matrix of 14 different achievement tests which are administered to each grade level as their measure of performance; and Howley (33) assessed student achievement by using the Comprehensive Test of Basic Skills (CTBS) which was administered to all children in West Virginia not enrolled in special education. For the purpose of the *current EOC* study, the existence of statewide data from the Palmetto Achievement Challenge Test (PACT) provides a wealth of student achievement information at both the school and district level.

The key issue, of course, is what the literature has to say about the relationship between school district size and student performance? In answering this question, the several survey articles referenced above prove to be quite useful. In his review of the pre-1989 literature, Hobbs (29) states that "these studies and many others that could be cited don't prove anything regarding student performance other than to effectively eliminated school district size as much of a factor affecting student performance." [4] A slightly different "read" on this material is provided by Webb (56) who indicates that the research falls into two camps, "those that found no consistent relationship between district size and student performance and those who found a negative correlation."[5]

Howley (31) in a more recent review of the subject observes that "recent studies uncover a negative relationship between school (or district) size and student achievement."[6] He muses that the advantage might come from the effect of small size on the achievement of disadvantaged students.

One of the more interesting aspects of the literature on district size and student performance, is the finding of an interaction effect between socioeconomic status and school district size. Beginning with a 1988 study by Friedkin and Necochea (22), a new line of evidence has developed the notion that the influence of both school and district size on student performance is contingent *on the* socioeconomic status of the students. The direction of the effect is that small districts (and schools separately analyzed) tend to better serve poor communities, while larger size is found to be productive for more affluent communities. More recent studies tend to support this finding. The most recent (2000) of these is Bickel and Howley (7) which does a good job providing an overview of the work done on these relationships and provides evidence for the state of Georgia.

The literature concerning the interaction between socioeconomic status and size raises an important issue for all concerned with the educational process. It turns the question of whether small or large districts are best for promoting student achievement to perhaps a

[4] Page 6
[5] Page 2
[6] Page 3

more relevant question of which type of student benefits from what size of district? *This suggests* that the ideas of a *"one-size fits all"* or "optimal" size districts are inappropriate concepts and one needs to be careful about such generalizations.

C. School District Size and Fiscal Efficiency

The second major concern of this report concerns the relationship between school district size and fiscal efficiency. The expectation that creating larger districts will lower the unit cost of providing education is one of the major drivers leading to the significant reduction in numbers of school districts noted earlier in this section. Reorganization of school districts was a national movement with dramatic decreases in the numbers of districts and increases in the average district size. As noted in Hobbs (29), "numerous authors have called attention to how principles of scientific management, which were widely adopted in industry through the period from 1920 through the 1960's, were generally extended to all other sectors of the society and economy including health care, education, etc."[7] The industrial principles of specialization, centralization and standardization became the theme for educational decision making.

In economic terms, educators embraced the concept of economies of scale, looking for decreasing average costs in a long-run setting. That is, with all inputs being variable, larger schools and districts will lower average costs as certain indivisible costs are spread over larger numbers of students. Further, other inputs are able to become more specialized and thus efficient as the scale of operation increases, further reducing average costs. The second part of the story is that beyond a certain size, economic theory points to the possibility of diseconomies of scale. Here, average or unit costs may actually begin to increase as business units (e.g. school districts) get even larger. The potential causes of this phenomena are: a) managerial or coordination problems may develop as a result of the extreme size of the organization; and b) the possibility that demand for certain key inputs may become so great that their prices are bid up, adversely influencing costs (e.g. having to pay above market teacher salaries to attract the numbers needed for a very large school district). These concepts are standard topics in any beginning economics textbook.[8]

One of the first issues to be addressed is how do researchers measure fiscal efficiency? The simplest answer to this question is average expenditure per student or total expenditure divided by the number of students. Fox (20) reviews eighteen pre-1980 district level studies and lists the measure of school costs used in each.[9] Included are instructional expenditures, total costs, current expenditures, current expenditures plus debt cost, administration costs, total expenditures net of debt service and contributions to building and loan fund, separate salaries, operating costs, and administrative costs, and so on. In each analysis, results are presented in average cost terms, dividing the cost measure used by number of pupils.

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[7] Page 2

[8] See for example O'Sullivan, Arthur and Steven Sheffrin, Economics: Principles and Tools, Second Edition, Prentice Hall, Upper Saddle River, New Jersey, 1998, pp. 173-181.

[9] See the "Summary of Education Size-Economies Research" table on pp. 7-12.

In commenting on this literature Fox (20) states that the "most common approach to testing for the size-economies concentrates on single-equation estimates on average cost functions. Researchers applying the cost function approach realized that only supply factors should enter into the equation used to analyze size-economies. But, instead of identifying a separate demand equation, these studies generally ignore the demand side of the market".[10]

This survey also discusses the use of a production function approach to examining the impact of district size on costs. A production function estimates the relationship between educational inputs and output. *In this approach*, input costs are not a part of the estimating equations. Fox (20) reviews the shortcomings of this approach including difficulties in accounting for technology, managerial skill, and human capital. He also points out that production functions are especially difficult to use for services, like education, where the input/output relationships are not clearly defined.

Finally, the most sophisticated types of models discussed by Fox (20) are referred to as "identified models". This approach involves empirical estimations with a system of equations where the attempt is made to completely specify the relationships specified in a theoretical model. Fox (20) states that identified models are preferred because "with proper estimation techniques they lead to unbiased coefficient estimation wherein the interactions between demand, supply, and input choices are taken into account."[11]

Duncombe, Miner, and Ruggireo (19) in a recent review observe that studies since 1990 have addressed most of the shortcomings identified by Fox (20). Many studies have explicitly included factor prices (e.g. teachers salaries) and several have made adjustments for teacher quality. Also, researchers have addressed the supply-side only issue by including demand factors in a behavioral system and have utilized either reduced-form expenditure functions or treaded student performance as endogenous. Even more recent studies have attempted to control for factors that are not easy to observe, such as efficiency.

The issue, of course, is what do these studies tend to show about the relationship between district size and fiscal efficiency? In reviewing the pre-1989 literature Hobbs (29) observes "most studies... have found some economies of scale, but they have also reported that these are heavily influenced by various situational factors including student population density, socioeconomic status of students, etc." Fox (20) in his review of over 30 articles concludes "savings can accrue from grouping more pupils under the same administrative district. These results indicate that small towns and less densely populated areas are likely to experience higher costs for providing the same quality of education than are medium size areas." More specifically, Duncombe, Miner and Ruiggiero (19) state that "principle cost savings are exhausted by the time a district reaches 500 to 1000

[10] Page 11
[11] See page 12

students...in fact there may be diseconomies to expanding a district beyond 5,000 students...thus forming a semi-U shaped cost curve."

Thus, despite significant variations in measures of cost, methodology, and geographic areas, there is a surprising amount of similarity in the results of all these studies. That is, almost all have found that economies of size exist over some range of enrollment. Many of also observed the possibility of U-shaped cost curves for most types of expenditures, indicating the existence of diseconomies of scale.

The implications of the above for a study of district size and fiscal efficiency for South Carolina school districts are several. First, it is clear that the modeling techniques for examining this issue have improved significantly over time. Researchers should then utilize what is considered to be "best practice" analysis in estimating this relationship for South Carolina. Second, the consistency of the findings noted above should imply that the expectation is to find that size economies do exist for the State's school districts. Third, however, since the findings of this research vary so much over different regions and with different techniques, one cannot accept on face value any of these findings as be applicable to South Carolina. Finally, it must be realized that fiscal efficiency is not the only factor to be considered in discussing the most appropriate sized school district. As noted in Part B, size and student performance must certainly be considered. As some researchers have stated, one cost of having school districts that are of the size that best promote student performance may be the fiscal inefficiency of that particular size.

D. Conclusion – Literature Review

The purpose of this section of the report was to provide an overview of the literature concerning school district size, student performance, and fiscal efficiency. It was observed that on the student performance side, the results tend toward a conclusion that with other things being equal, perhaps smaller districts promoted student performance. It was also found that this finding might not hold for all students. Research indicates that lower socioeconomic areas are perhaps best served by smaller districts whereas the opposite is the case for higher socioeconomic areas.

Secondly, the literature on economies of size strongly indicate that over at least a certain size range, cost savings are possible by promoting larger school districts. The question here is over what size range do savings occur and where do possible diseconomies begin? Another very important concern is balancing fiscal efficiency with student performance. The appropriated sized district in a fiscal efficiency sense may not be the most appropriate for promoting student performance.

4. A GIS Description of South Carolina School Districts

A major goal of this report was to provide an objective description of the current school districts in South Carolina. This description was important to providing an assessment of

the overall differences that exist throughout the state and the great disparity that exists in terms of the size, the financial base, the racial composition and performance of districts. Using the data provided by The EOC and the Department of Education it was possible to assemble extensive array information about the districts. By using the spatial analysis capabilities software geographic information system (GIS) software it was possible to transform information from the 2000 Census of Population and Housing into additional summary information for the school districts. By combining data from these different sources it was possible to construct a School District Fact Sheet (Table 6). This fact sheet provides summary information for twenty-seven different characteristics of the school districts.

The data in Table 6 demonstrate that the school districts range in size from 48.6 square miles in Sumter 17 to more that 1,226 in Berkeley County. At the same time the enrollment ranges from a low of 396 in Marion 4 to more than 58,000 in Greenville County (2001 data). By combining these figures it was possible to calculate a student density measure. This statistic provides an interesting indicator of the efficiency of a school district and the logistical problems with which some districts must deal. For example, the students in a rural district such as McCormick with only 2.8 students per square mile are likely to spend a disproportionate amount of time in school buses and the schools will have to be fairly small. In such sparsely populated areas it would be difficult to create larger schools without further increasing the travel time.

The wide range in the enrollment of the districts is also accompanied by a wide range in the number of schools within the districts. While it is reasonable that 47 of the 86 districts have a single high school it is surprising to find seventeen districts that only have a single elementary school. The figures also indicate the wide discrepancies in the racial composition of the districts. While the average district has about 50% minority enrollment, the districts vary from less than 8.0% to more than 98%. The disparity in terms of poverty level is not quite as great but it still ranges from 18.4 % to more than 97%. One of the most interesting characteristics of the districts is the change in the enrollment over the past decade. The enrollment decline in Union County of 58.75% reflects the overall population decline in the county. However, there are also differences in enrollment that are not directly related to general population trends.

The recently enacted uniform student assessment program provides a basis for grading the performance of students, schools and school districts. As expected, the results of these tests highlight the wide range of performance that exists throughout the state. One measure of this is the proportion of students who met the standard for tests in English and math. For 2001, the average for English was 68% with a range between 42.2% and 88.2 %. More striking is the fact that on average less than half the students (49.1%) earned a passing grade on the math part of the PACT test. In 2001, four districts earned an unsatisfactory grade on the tests and only two were judged to be excellent. The association between characteristics of the districts and the performance of the students is a major component of this report.

Table 6. School District Fact Sheet 2001					
Variable	Minimum	District	Maximum	District	Average
Area (Sq. Miles)	48.6	Sumter 17	1226.6	Berkeley	356
Population (2000 Census)	2,537	Marion 4	394,261	Greenville	46,193
Density (Students/Sq. Mile)	2.8	McCormick	181.6	Sumter 17	27.95
Enrollment	396	Marion 4	58,949	Greenville	7,602
White Enrollment	22	Bamberg 2	40,543	Greenville	4,252
Minority Enrollment	303	Greenwood 51	26,332	Charleston	3,416
% Minority	7.80%	Anderson 1	98.10%	Bamburg 2	50.80%
# of Elementary Schools	1	17 Districts	50	Greenville	7.1
Ave Elementary Enrollment	206	Marion 4	1272	Barnwell 45	519
# of Middle Schools	1	32 Districts	19	Charleston	3.2
Ave Middle School Enrollment	187	Barnwell 1	1116	Richland 2	577
# of High Schools	1	47 Districts	15	Greenville	2.3
Ave HS Enrollment	190	Marion 4	2533	Spartanburg 6	900
% at Poverty Level	18.40%	York 4	97.50%	Clarendon 1	62.70%
% Black Participation Grades 9-12	82.80%	Hampton 2	100.00%	Many	97.50%
% White Participation Grades 9 -12	32.40%	Bamberg 2	100.00%	Greenwood 52	86.00%
Change in Enrollment 1990 - 2000	-58.70%	Union	65.30%	York 4	1.50%
% Meeting English	42.20%	Florence 4	88.20%	York 4	68.00%
% Meeting Math	31.20%	Lee	84.60%	York 4	49.10%
Absolute Grade	2.0 2.0 2.0 2.1	Hampton 2 Jasper Lee Florence	3.4 3.5	York 4 Lexington 5	2.71
Millage Value	$3,485	Marion 4	$1,200,000	Greenville	$140,405
Ability Index	0.0003	Marion 4	0.1037	Greenville	0.0116
Tax Effort	0.66	Clarendon 2	1.85	Spartanburg 3	1.13
% Budget From Local	14%	Barnwell 1	80%	York 2	33.50%
Ave Teacher Salary	$31,068	Marion 3	$41,919	Spartanburg 3	$37,038
Student Teacher Ratio	7.1	Lexington 4	23.9	Chester	19.5
$ Per Student	$5,33	Spartanburg 2	$9,02	McCormick	$6,62

How we finance public education is a major public policy issue. Since a major proportion of the support for education falls on local taxpayers it is important to assess the financial resources of districts in different regions of the State and the differences between urban, suburban and rural areas. It is obvious that districts vary enormously in size and also the value of the property within there districts. One measure of the ability of a district to support its public schools is the revenue that is generated from property taxes by one mill. On average, this is $140,405. However, this varies from $3,485 to over $1,200,000. Therefore, it is clear that districts do not have an equal ability to provide local support for their public schools. Consequently, the reliance on state funding becomes a critical issue. As a matter of public policy, the State has an obligation to provide a minimum level of support for public education to supplement the local government's financial sources. In fact, state tax revenues are intended to equalize the ability to support public education throughout the State.

While there are major differences in the ability of the residents to support public education there are also differences in the effort or willingness of the taxpayers to provide the tax revenues. The measure of effort ranges from .66 to 1.85 with the average around 1.13. The combination of the financial base and the willingness to support public education ultimately leads to the amount of revenue that is generated in a district. One measure of whether there is an equal basis is the proportion of a school district's budget that comes from local property taxes. The discrepancy throughout the State is enormous, ranging from 14% in Barnwell 19 to 80% in York district 4. It is important to note the wide difference in economic base that exists throughout the state and to note that the reduction of the state budget for the Department of Education impacts poor districts to a much greater degree than the more wealthy ones. In many districts there simply is very little local property tax base to offset the reduction in the State's share. It should also be noted that the cost of educating as well as providing transportation and facilities varies by about $3,700 per student in different parts of the state.

The final set of factors that are listed in Table 6 pertains to the operation of the districts. On average the districts pay teachers about $37,000 per year. This varies about $10,000 between districts. The ratio of students to teachers also varies considerably, ranging from 7.1 to 23.9. Please note that maps depicting the distribution of some of these district characteristics will be included in Appendix C.

In addition to simply looking at the range of the values for the different characteristics the research team also analyzed the overall distribution of the factors that distinguish the districts. For example, the bar chart of the distribution of enrollment for the districts demonstrates the highly skewed nature of the enrollment. For example, Greenville and Charleston counties have large countywide districts with enrollments of 58,949 and 42,025, respectively. At the same time, the vast majority of the districts (56) had enrollments less than the average of 7,602 students. The bar graph of the proportion of minority students highlights the extraordinary range across the State and reflects the segregated nature of the geographic distribution of the population of South Carolina. The map of this distribution (Map #1) provides an excellent way to depict the geographical

differences in the concentration of non white population are found in the coastal plain and in the inner city neighborhoods of large cities. Another important graph provides a more complete picture of the importance of the State support for financing public education. Only seven districts in the State are able to provide more that 50% of their budgets from local sources. Twenty-two districts rely on state sources for more that 75% of their budget.

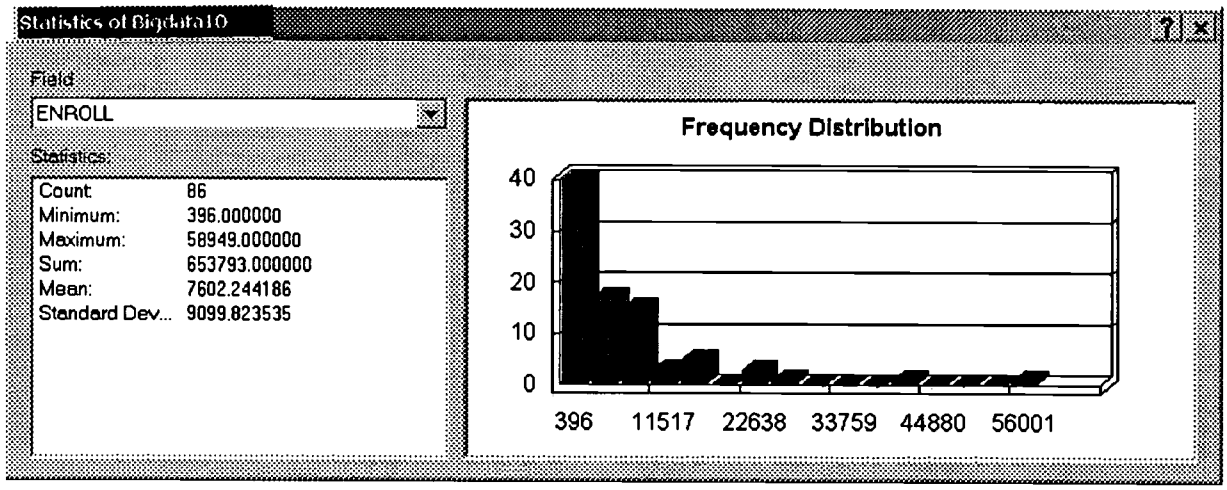


Figure 1. Distribution of the size of the enrollment in districts

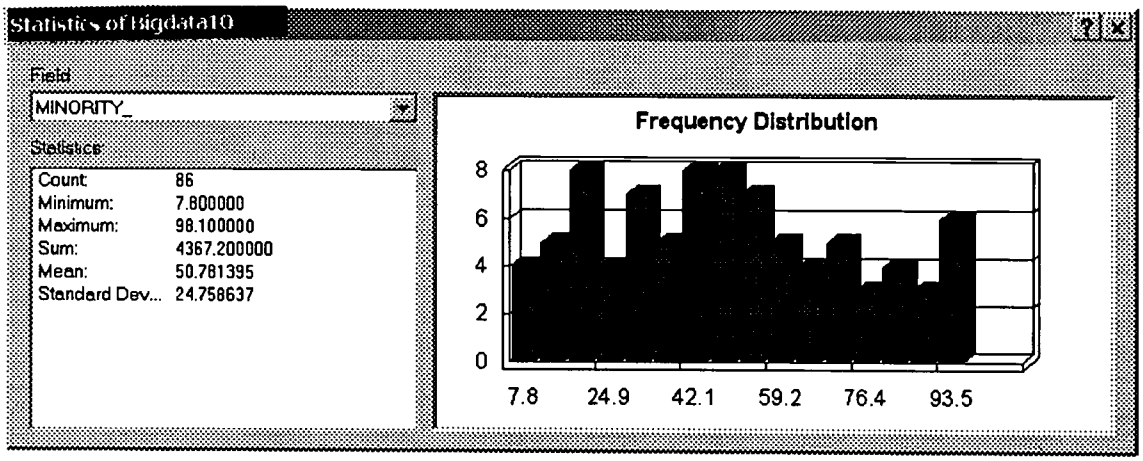


Figure 2. The proportion of minority students in a district.

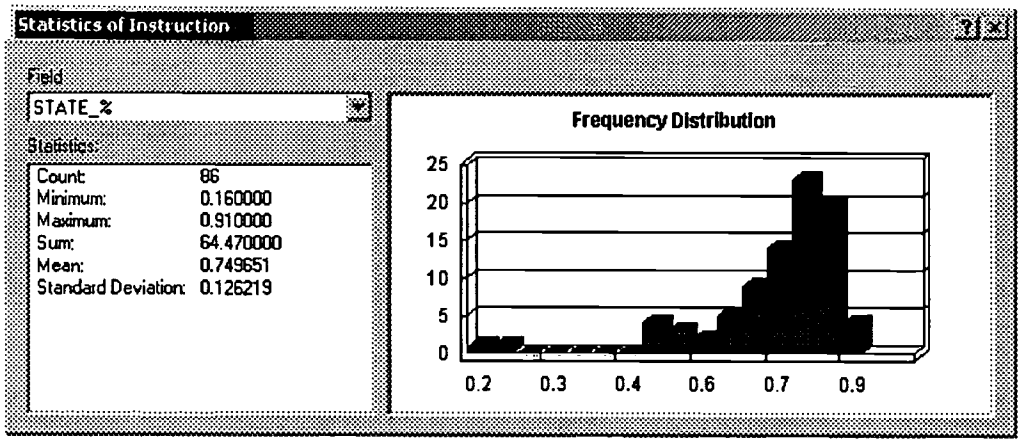
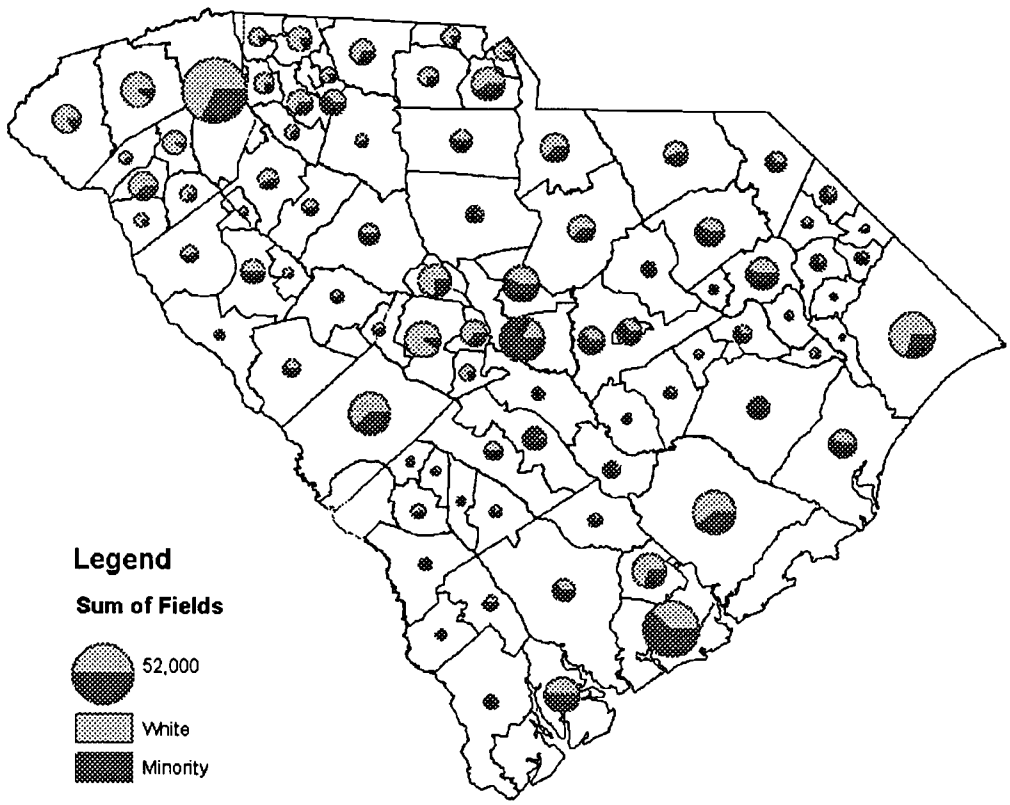


Figure 3. The proportion of budget that comes from state sources

From the GIS analysis it was possible to generate a series of maps that highlight the geographical differences that exist throughout the State. By displaying the enrollment in the districts as a set of circles that vary in proportion to the total enrollment it is possible to quickly assess the wide range in the size of the districts and note the fact that counties have taken very different approaches to how they divide their counties into school districts (See Map #1). Some large counties such as Greenville and Charleston have one countywide district while many small counties have carved their counties into numerous small districts.

Map #1 also indicates that it is difficult to generalize about the geographical pattern to the number of districts within a county. While there is a tendency for counties between the coast and the midlands to have several small districts it is also important to note that Spartanburg has seven districts. By dividing the circles into pie charts on the basis of race it is possible to highlight the areas of the State that have the largest proportion of minority students. It is also apparent that the racial composition of the districts within a county also varies widely.

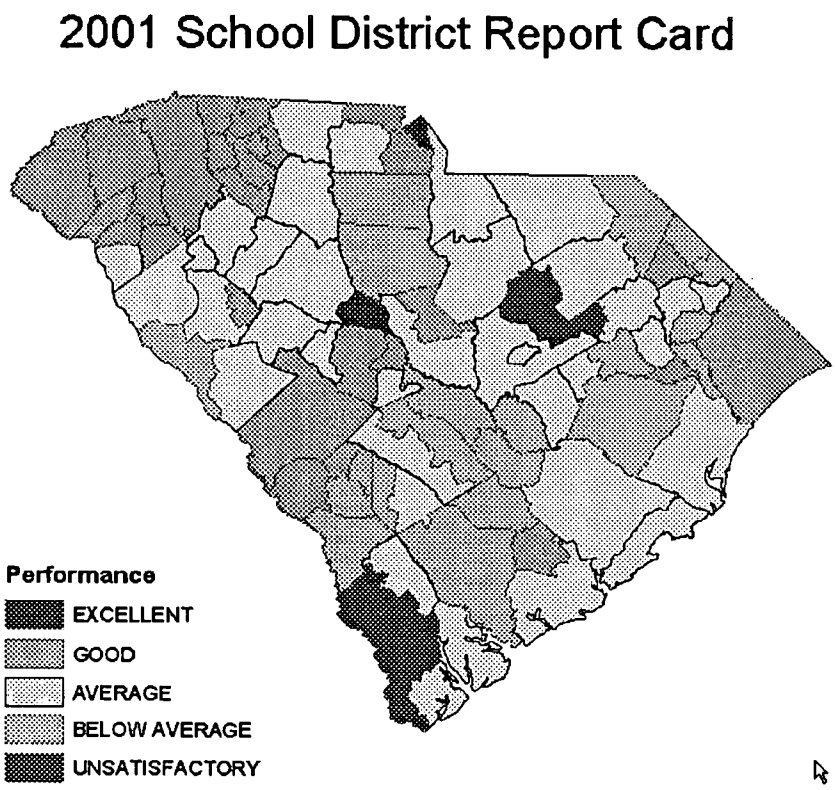
District Enrollment by Race 2001



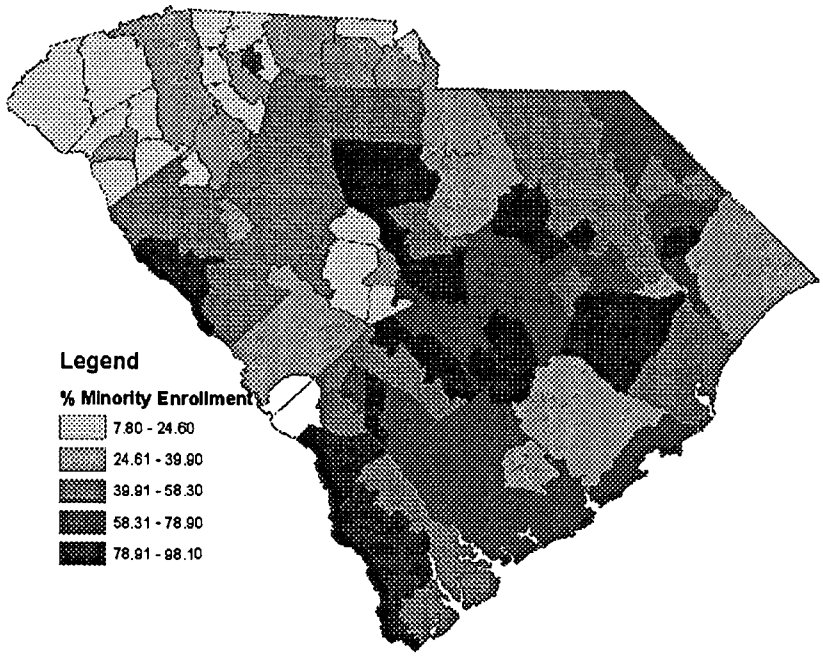
Map 1. **The size and racial composition of the school districts**

School District Organization in South Carolina

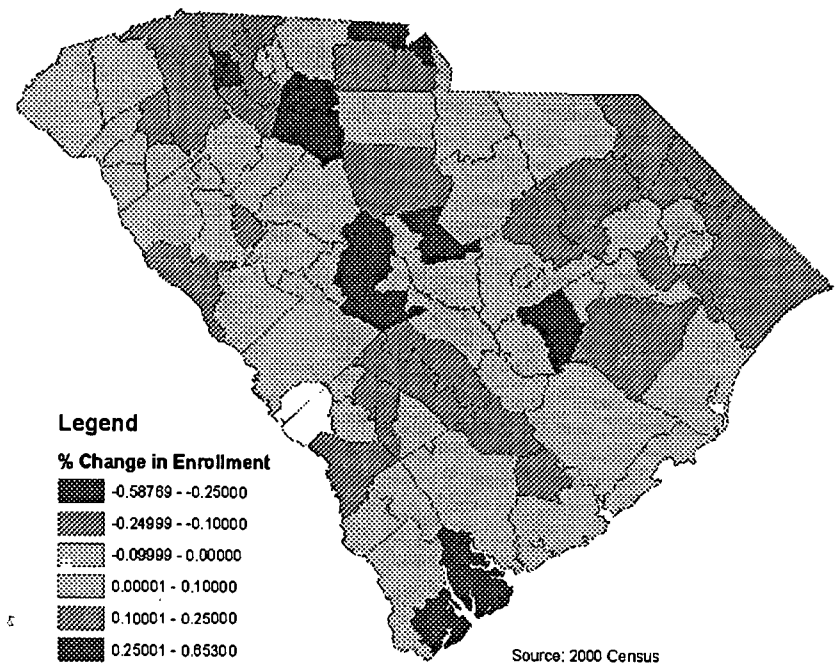
Map #2. School districts in South Carolina



Map #3 School district performance



Map #4 **Proportion of minority students**



Map #5 **Enrollment changes in districts 1990- 2000**

The relationship between performance and the characteristics of the school districts

An important part of this study was to examine the characteristics of school districts in relationship to the performance of the students. Since each district was given its own report card grade it was possible to examine the characteristics of the districts that received the same grade. While it is not the intent of this part of the report to draw conclusions about what factors lead to better performance of the students on the assessment test, the data do provide a good way to draw some preliminary generalizations. For example, by examining the characteristics based on enrollment (Table 7) it is apparent that those districts with good to excellent report card districts averaged about 10,000 students. It is also interesting that there is a big drop in average enrollment from 8,000 to 3,100 between average and below average school districts. The districts with the worst grades averaged only 2,100 students and had a single high school.

DISTRICT GRADE	Enrollment	ELEMENTARY ENROLLMENT	MIDDLE SCHOOL ENROLLMENT	HIGH SCHOOL ENROLLMENT	NUMBER OF ELEMENTARY SCHOOLS	NUMBER OF MIDDLE SCHOOLS	NUMBER OF HIGH SCHOOLS
EXCELLENT	9955.0	626.0	783.0	1470.5	6.5	3.0	2.0
GOOD	11065.3	562.5	663.3	1113.7	9.3	3.9	2.8
AVERAGE	8061.4	507.7	590.7	881.1	8.0	3.6	2.6
BELOW AVERAGE	3183.4	468.1	448.5	658.7	3.6	2.0	1.5
UNSATISFACTORY	2108.0	552.8	455.3	609.8	2.3	1.5	1.0

Table 7 – The relationship between district performance and enrollment measures

A second table (Table 8) examines some of the general characteristics of the teachers and student/ teacher ratios. The most striking generalization is the differences in the teacher salaries and the proportion of teachers with master's degrees. More that 50% of the teachers in the districts that received an excellent grade have masters degrees and they pay their teachers more that $5,000 a year more than the districts with failing grades. There appears to be a consistent trend in terms of the relationship between teacher salaries and the proportion of teachers with master's degrees and performance. One could conclude that it is very difficult for the poor districts to recruit good teachers and the pay them a competitive wage. It is interesting that the best performing districts do not have the lowest student teacher ratios. This relationship is probably an indication of small classes in rural schools. These small districts must offer classes in all grades from k-12 even with declining enrollments. While the better performing district may be working to reduce the student teacher ratio they have rapidly expanding enrollments and larger class sizes. Table 8 suggests that those good districts are willing to pay higher salaries and recruit teachers with master's degrees. It appears that the poorer districts are not able to recruit the same quality of teachers. This suggests that there may be a need to provide additional incentives to overcome this gap – or there will never be any equalization of opportunity for all students.

District Grade	% Parent Attending Conferences	Drop Out	Student Teacher Ratio	% Masters	Ave Teacher Salary
EXCELLENT	76.80%	1.9000	21.8500	50.3500	$39,408
GOOD	80.24%	2.4846	20.7615	44.0500	$38,786
AVERAGE	80.12%	3.1324	19.3235	39.0719	$36,503
BELOW AVERAGE	72.33%	3.9150	18.3250	33.6368	$36,008
UNSATISFACTORY	60.45%	3.0500	18.4000	27.6750	$34,210

Table 8. Characteristics of teachers in relationship to performance of districts

The next table (Table 9) illustrates the relationship between the geographical characteristics of the districts and performance. One of the most interesting aspects of the table is the relationship between the density of students and performance. Using GIS, the density was calculated as the number of students per square mile of the district. The figures suggest that there is a direct relationship between density and performance. The two excellent districts have densities of over 90 students per square mile while the poorest performing districts have average densities of only 7.7. This density measure is a good indicator of the nature of the geographic characteristics of a district. High densities are found in compact suburban districts, while low densities are an indication of sparsely populated rural areas. It is also interesting to note that "good" districts have densities of only about 50% of the excellent ones. Therefore the geographic factors may play a major role in defining the characteristics of the very best districts. The lower densities are also directly related to higher per student transportation costs. These costs suggest that the students spend more time in buses that probably hurts performance. It is also important to note the difference between the change in enrollment over the past decade and performance. Excellent districts experienced massive enrollment increases during the last decade. The districts with excellent grades also grew faster than the rate of total population within the district. This suggests that demographic migration shifts from inner neighborhoods and the general suburban growth trend. This might be characterized as "white flight".

District Grade	Enrollment	Student Density Students/ Sq. Mile	Square Miles	Transportation Per Student	Net Change in Enrollment 1990 - 2000	% Change in Enrollment	% Population Change
EXCELLENT	9955.0000	93.2300	107.1	$138	2501.0000	45.22%	38.54
GOOD	11065.2692	47.0615	281.0	$147	1379.8846	13.11%	17.52
AVERAGE	8061.3529	22.6526	420.1	$148	-148.7647	-1.56%	14.21
BELOW AVERAGE	3183.4000	9.6350	369.8	$181	-338.0500	-9.91%	5.99
UNSATISFACTORY	2108.0000	7.7175	354.0	$185	-254.2500	-10.76%	17.65

Table 9. Geographic characteristics in relationship to performance of districts

The policy implications of the data in this table could be quite significant. It suggests that the quality of the schools in a district is an extremely important indicator of where the population of the South Carolina desires to live and the potential support for public schools. It also suggests that enrollment in many districts has declined significantly over that past decade. Some of this decline can be accounted for by general demographic trends, however, the data strongly suggests that public school enrollment is declining faster that can explained by these general trends. The current trends are likely to continue and we are going to see the pattern of overcrowded schools in suburban districts that are willing and able to support public schools. At the same time the poorly performing districts are going to continue to witness declining enrollments, and be unable to maintain their facilities. Class sizes will continue to decline making it difficult to maintain efficient operations.

Another way to examine the district performance data is analyze the financial characteristics of the districts. Table 10 provides a clear notion that the local government's ability to support public education directly impacts performance. Most striking is the fact that the districts with below average and unsatisfactory grades are not able to provide the financial resources necessary to support a viable public school system. The difference in the value of a mill of property tax is enormous. This again strongly points to the need for increased state support for these districts and the potentially disastrous impact of state budget cuts on these districts. It should also be noted that the tax effort, or willingness to tax the property is not associated with the performance of the district. It can be argued that the poorly performing districts make the effort but simply do not have sufficient financial resources.

District Grade	Mill Value	Ability to Pay	Tax Effort	% Local Budget	Ave Teacher Salary
EXCELLENT	$175,244	0.0137	1.1495	41.00%	$39,408
GOOD	$215,857	0.0179	1.1198	39.62%	$38,786
AVERAGE	$151,743	0.0125	1.0949	30.76%	$36,503
BELOW AVERAGE	$43,106	0.0038	1.2119	31.25%	$36,008
UNSATISFACTORY	$22,677	0.0019	1.0522	25.00%	$34,210

Table 10 – Financial characteristics of districts in relationship to district performance

It is always a sensitive issue to examine the relationship between race, poverty and the performance of students. The following table (Table 11) is provided simply in a factual manner because the associations cannot be ignored. It is evident that the districts that have students that are performing best on the factors that determine the district's grade have less than 20% minority students and about 30% of the students qualify for school lunch programs which is the measure of poverty. This can be contrasted with the profile of students in the unsatisfactory districts, which have an average of 91% minority students and 88% students at the poverty level. The averages for the all of the grades are inversely related.

In order to better understand the association between these characteristics a correlation analysis was conducted. The correlation coefficients are .67 for minority and .75 for poverty. The statistics indicate that poverty is more directly related to performance than is race. In fact, there are four districts that have of minority proportions greater that 49% that earned a "good" rating. The implications of these data are also significant. They suggest that it is difficult for schools to prepare students that come from an economically disadvantaged family for the tests that are used for the rating. They also suggest that students in these districts may need the most qualified teachers. Unfortunately, these schools are located in areas that cannot provide the resources required to hire the most qualified teachers. These students also tend to live in rural areas with very low densities. They are likely to spend a significantly greater amount of time riding the bus to and from school. This directly impacts their performance in school.

District Grade	Number	% Minority	% Poverty
EXCELLENT	2	18.15%	30.10%
GOOD	26	29.17%	45.97%
AVERAGE	34	49.03%	62.80%
BELOW AVERAGE	20	77.05%	82.46%
UNSATISFACTORY	4	91.10%	88.73%

Table 11 – Minority and poverty characteristics in relationship with district performance

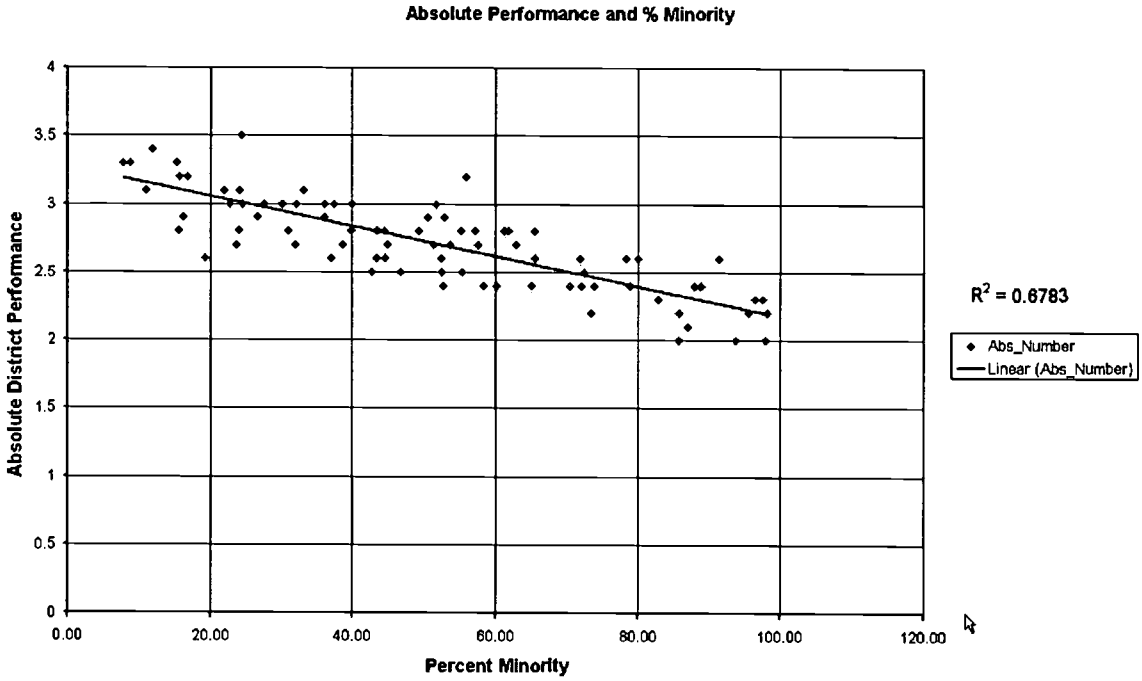


Figure 4. – The relationship between district performance and minority

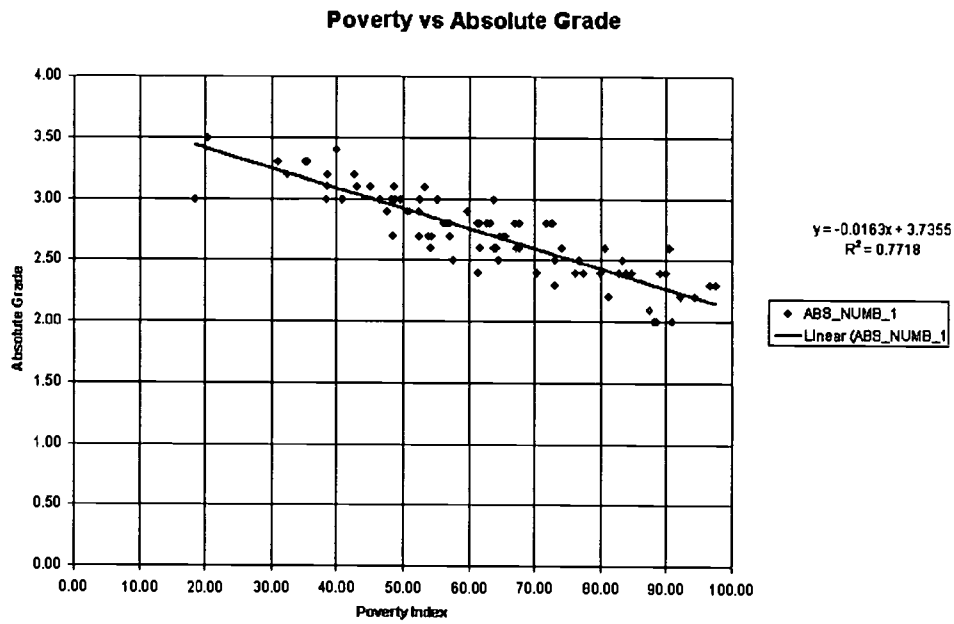


Figure 5. – The relationship between district performance and poverty

The research team also conducted an in-depth analysis of the expenditures of schools districts and the relationship to performance. One way to examine this relationship is by looking at the proportion of the budget spent on different categories. The figures in the Table 12 provide very strong evidence of the importance of direct expenditures on instruction and more directly on teacher salaries. Those districts that performed at the excellent rating were able to devote 60% of their budget to instruction, while those that performed the worst were able to spend less than 55%. The relationship is directly explained by the fact that the best districts have about 10,000 students living in densely populated parts of the State. The worst performing districts had only about 2,100 students that came from areas with a density of only 7.7 students per square mile. The small districts with smaller student teacher ratios appear to be inefficient. They have disproportionately high expenditures for the fixed costs associated with leadership and operations. Another way to look at the same figures is to calculate them on a per student basis (Table 13). As with the proportion of the budget spent in different categories the cost per student also demonstrates the inefficiency of small districts in sparsely populated parts of the state. Even though the unsatisfactory districts are spending almost $1,200 per student more than the excellent districts the results are terrible. They are spending too much on fixed costs for leadership and operational costs and not enough on teacher's salaries and hiring better-qualified teachers with master's degrees.

Percentage of District Expenditures					
RATING	INSTRUCTIONAL	TEACHERS	LEADERSHIP	OPERATIONAL	INSTRUCTIONAL SUPPORT
Excellent	60.26%	54.20%	6.98%	19.50%	13.26%
Good	59.17%	52.35%	8.37%	19.49%	12.90%
Average	58.36%	50.24%	9.26%	19.39%	12.92%
Below Avg	55.38%	48.32%	10.73%	21.21%	12.67%
Unsatisfactory	54.38%	34.88%	10.36%	21.71%	13.54%

Table 12 – District proportion of budget expenditures for different categories by performance

Expenditures Per Student					
RATING	TOTAL	INSTRUCTIONAL	LEADERSHIP	OPERATIONAL	INSTRUCTIONAL SUPPORT
Excellent	$6,875	$4,141	$481	$1,338	$916
Good	$6,977	$4,114	$584	$1,367	$907
Average	$7,007	$4,085	$650	$1,361	$906
Below Avg	$8,014	$4,398	$873	$1,720	$1,021
Unsatisfactory	$8,005	$4,351	$833	$1,735	$1,086

Table 13 – Per student district expenditures in relationship to performance

The impact of school quality on public school participation rates.

In 2000, the decennial Census of Population and Housing compiled data for participation in public and private schools. This is the first time that the data has been collected at the census block group level for black and white students in nursery school, kindergarten, grades 1 through 8 and grades 9 – 12. By using GIS procedures it was possible to allocate these data to the school districts. The data provide a direct way to measure whether students living in a district are attending public or private schools. Before this data was available it was only possible to make fairly broad statements about the number of students attending private schools within a county. By compiling these data for each school district it was possible to assess the quality of the school district as measured by the district report card grade with the participation rates. The two following tables summarize the findings. The Table 14 lists the estimate of the proportion of black students living within a district who attend public schools in kindergarten, grades 1-8 and high school. These figures indicate that black student participation rates are very high regardless of the quality of the schools. The only real difference is that at the high school level the proportion drops to 93%.

Black Student Participation Rates			
District Grade	Kindergarten %	Grades 1-8 %	Grades 9-12 %
EXCELLENT	94.82	98.29	97.82
GOOD	94.67	98.18	98.03
AVERAGE	95.45	98.59	97.39
BELOW AVERAGE	97.94	98.46	98.10
UNSATISFACTORY	96.11	97.54	92.76
STATE WIDE	94.60	97.70	96.91

Table 14 – The black participation rate for school districts derived from the 2000 Census of Population

The second table (Table 15) lists the figures for the white students in each district. The figures in this table indicate a dramatically different pattern. The most striking conclusion is that the quality of schools in a district directly and strongly determines whether white students will choose to attend public schools. It is very clear that if the schools are judged to be excellent or good the parents of white students will send their children to the schools. They are also highly likely to support the efforts of the school administration to financially support the schools. Conversely, white parents living in districts with schools that are judged to be below average or unsatisfactory send their children to public schools in significantly lower proportions. In fact, at the high school level only about 55% of the white students are attending the schools in districts with unsatisfactory ratings.

The differences between white and black participation rates are very significant. For excellent districts there is only a 1.3% difference between white and black participation at the high school level. This figure, increases to 38.2% for unsatisfactory school districts.

The implications of these findings further highlight the blight of the districts with poor report card ratings. These districts, which already have obstacles relating to their meager financial base, inability to recruit teachers, and disproportionate expenditures on operational costs are also unlikely to have the support of general population. A significant number of white families are sending their children to private schools. It is also apparent that the rate of decline in enrollment in these districts is likely to be associated with white parents removing their children from the schools district rather than the general demographic trends in the area.

White Student Participation Rates			
District Grade	Kindergarten %	Grades 1-8	Grades 9-12 %
EXCELLENT	80.28	92.0	96.50
GOOD	80.32	90.8	93.26
AVERAGE	77.44	85.8	88.45
BELOW AVERAGE	60.66	74.2	77.64
UNSATISFACTORY	52.36	49.2	54.60
STATE WIDE	73.05	85.0	87.52

Table 15. The white participation rate for school districts derived from the 2000 Census of Population

The relationship between race and participation rates for the high school level is depicted in the following graph and maps 6 and 7.

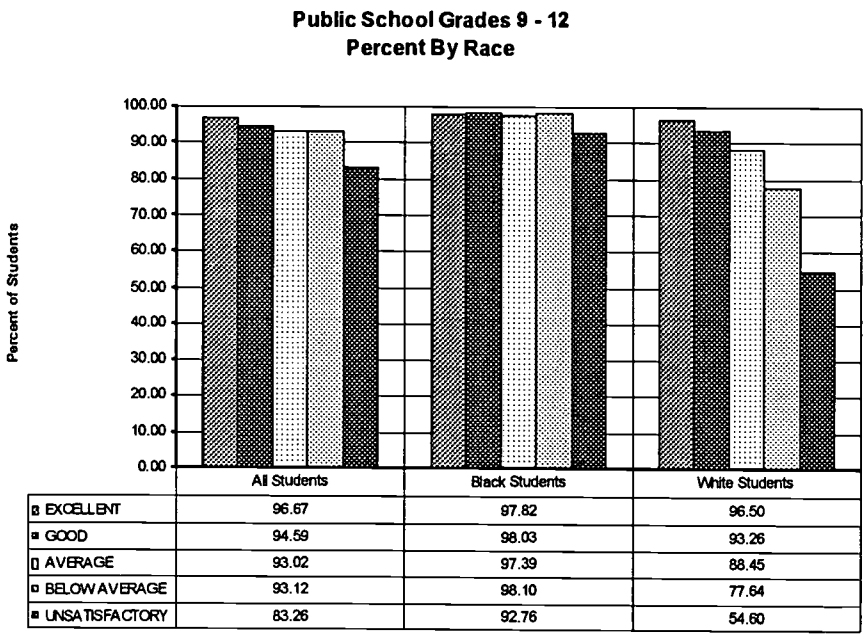
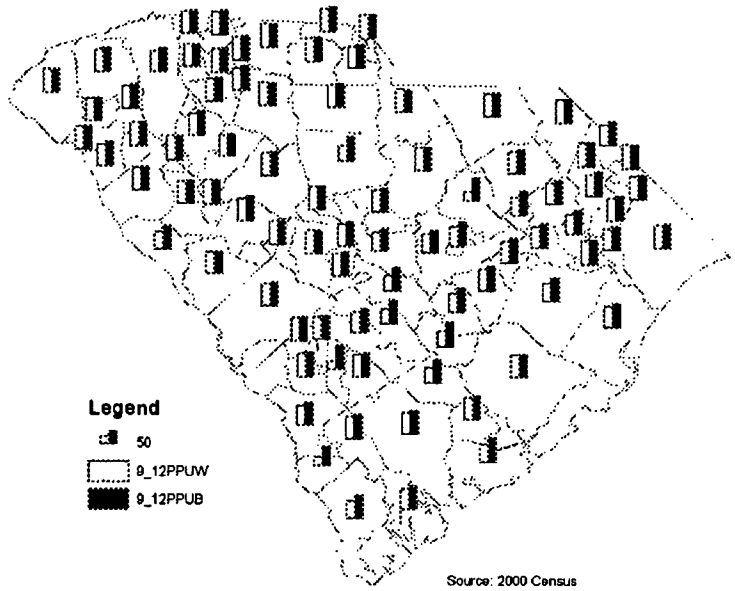
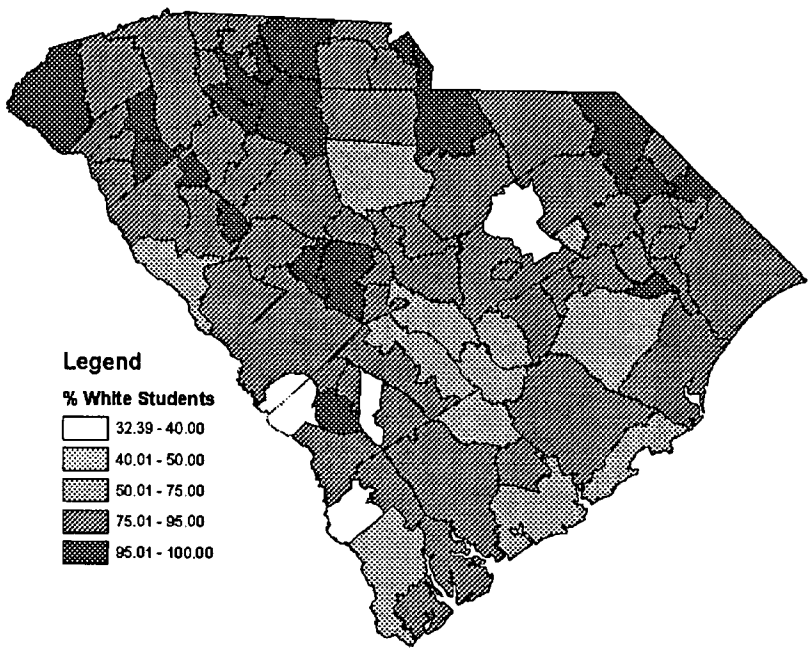


Figure 6. – The relationship between district performance and participation rates for black and white students in grades 9 – 12.



Map 6. - The differences in black and white participation rates for high school students



Map 7. The percentage of white students attending public high school

5. School District Size And Student Achievement

A. Introduction

The issue of concern for this section of the study is to present the empirical evidence which examines the relationship between school district size and student achievement. Existing literature has been reviewed and provides the background for the results. As noted in Section 3, some of this literature indicates that there is no consistent relationship between district size and performance while other studies have found a negative correlation between the two. The most interesting of the recent work on this subject is the finding of an interaction between district size and socioeconomic status of the student population. This work concludes that the impact of both school and district size on student performance is contingent on the socioeconomic status of students. These issues are examined in this section.

The nature of the data set used for this work is outlined in Part B of this section. The data set is robust in the sense that it includes all public k-12 schools in the state of South Carolina. This is unique since most other studies utilize data for only a particular grade or set of grades in a state. Summary statistics are presented and discussed. Part C presents the regression results that test various hypotheses that were generated in the literature review. Of specific interest is the relationship between district size and student performance and whether this relationship is codependent with socioeconomic status. The section concludes with a summary and conclusions of the empirical results.

B. The Data

The South Carolina Economic Oversight Committee and the South Carolina Department of Education provided information on school and district size, student performance, and measures of socioeconomic status. A much larger data set including other variables was developed but only the above mentioned information was utilized for this section of the report. The dependent variable on student achievement is a school level variable since that is the level at which education is delivered. The impact of district level factors on achievement can of course be analyzed by including such variables as explanatory or right-hand size variables.

Table 16 summarizes the descriptive statistics for the variables to be used in the regression analysis presented in Part C. As noted above, the number of observations is quite large (over 1,000 schools). This includes 184 high schools, 268 middle schools, and 611 elementary schools. Due to the size of this data set, it is possible to divide the schools into these three categories creating a more homogeneous group of students in

each, while still maintaining a large enough group to avoid degrees of freedom problems. Table 16 then summarizes the information for each subgroup.

TABLE 16

DESCRIPTIVE STATISTICS

HIGH SCHOOLS

VARIABLE	NUMBER OF OBSERVATIONS	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PERFORMANCE	184	2.94	0.76	1	5
POVERTY	184	48.53	21.3	9.3	97.1
SCHOOL ENROLL	184	9.58	5.5	0.94	30.96
DISTRICT ENROLL	184	163.28	163.41	3.96	589.49
ENR SCHOOL*POV DIST	184	517.08	287.4	57.43	1792.5
ENR DIST*POV SCHOOL	184	7083.7	5087.83	328.28	38345
ENR DIST*POV DIST	184	8433.27	7858.02	352.84	25689.5
ENR SCHOOL*POV SCHOOL	184	405.4	228.29	55.94	1338.62

MIDDLE SCHOOLS

VARIABLE	NUMBER OF OBSERVATIONS	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PERFORMANCE	268	2.65	0.41	1.4	4.2
POVERTY	268	58.81	20.95	8.9	98.9
SCHOOL ENROLL	268	6.35	2.62	0.21	14.62
DISTRICT ENROLL	268	162.63	157.61	3.96	589.49
ENR SCHOOL*POV DIST	268	347.27	141.97	14.21	769.12
ENR DIST*POV SCHOOL	268	8864.34	9436.33	328.28	52287.76
ENR DIST*POV DIST	268	8475.98	7718.27	352.84	25689.5
ENR SCHOOL*POV SCHOOL	268	348.52	155.69	19.5	911.89

ELEMENTARY SCHOOLS

VARIABLE	NUMBER OF OBSERVATIONS	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PERFORMANCE	611	2.94	0.41	1.5	4.1
POVERTY	611	63.6	22.62	5.9	100
SCHOOL ENROLL	611	5.12	2.28	0.22	20.96
DISTRICT ENROLL	611	178.65	162.2	3.96	589.49
ENR SCHOOL*POV DIST	611	272.09	132.9	11.94	1284.85
ENR DIST*POV SCHOOL	611	10916.31	11177.28	371.84	54763.62
ENR DIST*POV DIST	611	9100.01	7944.75	352.84	25689.5
ENR SCHOOL*POV SCHOOL	611	305.47	147.27	4.18	1536.37

The variables presented are:

PERFORMANCE:

Measured at the school level, this will be the dependent variable in the regression analysis. As noted in the literature review, a variety of test scores have been used in other studies to measure student achievement. We are fortunate in South Carolina to have a skills based statewide testing program measuring student achievement at all three levels of schooling. The Palmetto Achievement Challenge Test (PACT) has been given for four years with results given to each student and aggregated to the school and district levels. The five terms for rating schools and districts are excellent, good, average, below average, and unsatisfactory. Numerical ratings match these terms range from 1 (poor) to 5 (excellent) with 0.1 point increments. As seen in Table 16, ratings for individual high schools range from 1 to 5 with a standard deviation of .76. The mean school score was 2.94. All data is for the 2000-2001 school year. Information for middle and elementary school is also presented in Table 16.

POVERTY

The most frequent variable specified in the literature, which explains a significant amount of the variation in student achievement, is some measure of socioeconomic status of the students. Again, a variety of measures have been used, with percent of students being on "free and reduced rate" lunch programs being one of the more popular variables. For this work, the poverty index measure used by the EOC that includes free and reduced lunch and eligibility for Medicaid at any time in a three-year period was used for both school and district levels. This measure ranges from 0% (no students classified as poor) to 100% (all students so classified). The data reported in Table 1 show these values for the school level population. Again, the school level is closest to the individual and you can have rather significant differences in poverty rates between schools in the same district. The range of this poverty index for South Carolina high schools is quite large, ranging from 9.3 points (percent) to 97.1 points. The standard deviation is 21.3 points with a mean of 48.53 points. Similar ranges are noted for both middle and elementary schools, with the later having the biggest range of all.

SCHOOL ENROLL

This and the following variable are intended to capture the impact of "size" or "scale" on student achievement. While the literature review indicated several measures of size (e.g.- square miles contained in a school district), it was decided to keep with tradition and simply use an average enrollment value as an indicator of size. This is the most often used measure and allows our results to be comparable in this manner to most of the other literature on this subject. Thus, the values here are number of students for each of the schools. The range for high schools is from a school with 94 students to one with 3,096

students. The standard deviation is 550 students and the mean school size is 958 students. Similar ranges are noted for middle and elementary schools. One interesting point is the extremely large maximum school enrollment value for elementary schools (2,096 students). This is listed in the data set as the Chester Park Complex in Chester School District. [12]

DISTRICT ENROLL

As with the preceding variable, this is an enrollment value at the school district level. Thus, district enrollment variable has the same value for each school in a particular district. Also, since all districts have elementary, middle and high schools, the minimum and maximum values are the same for all three levels of school. As seen in Table 16, the smallest school district has 396 students and the largest has 58,949 students. Since the number of schools in each district differ, the means and standard deviation values vary by school category, but not a to a great extent.

ENR SCHOOL*POV DIST

This and the following threes variable are designed to test the hypothesis that the impact of size (school and district) on student performance vary with the socioeconomic status of the students. These are the same set of interaction variables found in Bickel and Howley (7). The variable specified here is the product of school enrollment and the poverty index for the district. The later is the same index described above, only calculated for the school district rather that the individual school. Thus, as an explanatory variable, it allows one to examine the impact of the interaction of school size and the socioeconomic status of the district on student performance.

ENR DIST*POV SCHOOL

The interaction here is between district size and the poverty index for the school. This variable is the product of the district enrollment and the school level poverty index. This variable will help us examine questions such as: Do students in poor schools perform differently in larger or smaller districts? Do students in schools with lower poverty indexes (higher socioeconomic levels) perform differently in different size districts?

ENR DIS*POV DIST

Here the interaction between size and poverty is measured at the same level. That is, the interaction is between enrollment and poverty at the district level. As such, one can examine this interaction and its impact on student achievement. Is there a difference in student achievement between small/poor districts and large/poor districts? This and similar questions are possible to examine with this variable.

[12] Enrollment values for both schools and districts are measured in hundreds of students when used in the regression equations.

ENR SCHOOL*POV SCHOOL

This is the last of the size/socioeconomic interaction variables. Like the previous calculation, this is the enrollment size measures times the poverty index, but this time it is calculated at the school level. So now the question might be, is there a student achievement difference between students in small/poor schools and those in large/poor schools? This type of question plus the others suggested above can be examined utilizing these four interaction variables.

C. Regression Analysis

Table 17 highlights the empirical evidence on the relationship between school and district size and student performance. Ordinary least squared regression techniques were employed using the SAS system software release 8.02. Results shown include the parameter estimates, standard errors of estimates, t values, R squared values and F values. Three sets of equations are run for each of the three levels of school groupings (high schools, middle schools and elementary schools). These three sets increase in sophistication and complexity as more explanatory variables are added to the equations. For all regressions, the independent or left-hand-side variable is ***PERFORMANCE*** (average school level PACT score ratings).

The first regression (Regression 1) that is estimated is simply the ***PERFORMANCE*** variable regressed on ***POVERTY*** (school level poverty index). As noted in the literature review and recognized by almost every education researcher, the socioeconomic status of students plays a major role in the achievement or performance of students. Table 17 includes the results for Regression 1 for each of the three groupings of schools certainly confirms this conclusion for South Carolina schools. At all three levels, the ***POVERTY*** parameter or coefficient is negative and highly significant. This indicates that schools with higher poverty indexes tend to score lower on the PACT. The R squared values indicate that this index of poverty explains between 66 to 70 percent of the variation in ***PERFORMANCE.***

In Regression 2 (second section for each school category in Table 17), we begin to address the roll of school and district size on student performance or achievement. Thus, the variables SCHOOL ENROLL and DISTRICT ENROLL are added to POVERTY as additional explanatory variables. It is noted in most of the recent literature that the potential impact of scale factors on student performance works both through school size and district size so both should be considered. The sets of regression results shown in the second set of regressions in Table 17 incorporate school and district size in the most direct way. The interpretation of these results is whether or not district and school size impact student performance, holding school poverty levels constant (i.e., by including the poverty variable in the regression). As can be seen, the coefficient or parameter for SCHOOL ENROLL is negative and significant in two of the three regressions.

Table 17

Regression Results

Dependent Variable: Performance

1. High Schools

Regression 1 – High Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	4.345	0.082	53.08	***
POVERTY	-0.029	0.002	-18.74	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.66			
F Value	351.31			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

Regression 2 – High Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	4.649	0.143	32.6	***
POVERTY	-0.031	0.002	-17.46	***
SCHOOL ENROLL	-15.0	0.007	-2.22	**
DISTRICT ENROLL	-0.0002	0.0002	-1.12	
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.67			

F Value	122.4

Table 17 (Cont.)

Regression 3 – High Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	4.39	0.125	35.08	***
POVERTY	-0.027	0.002	-12.65	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST	-0.0003	0.0003	0.79	
ENR DIST*POV SCH	-0.00002	0.00001	-1.81	*
ENR DIST*POV DIST	0.00002	0.00001	1.42	
ENR SCHOOL*POVSCH	0.00006	0.0004	0.13	
R Squared	0.67			
F Value	72.99			

2. Middle Schools

Regression 1 - Middle Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.612	0.042	87.05	***
POVERTY	-0.016	0.0006	-24.63	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.7			
F Value	606.66			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

Table 17 (Cont.)

Regression 2 - Middle Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.73	0.0723	51.97	***
POVERTY	-0.017	0.0007	-22.94	***
SCHOOL ENROLL	-0.011	0.006	-1.78	*
DISTRICT ENROLL	-0.00006	0.00009	-0.68	
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.7			
F Value	205.38			

Regression 3 - Middle Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.62	0.057	63.46	***
POVERTY	-0.015	0.0008	-17.89	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST	-0.0005	0.0008	-.181	*
ENR DIST*POV SCH	-0.00001	0.000005	-2.99	***
ENR DIST*POV DIST	0.00001	0.000001	2.83	***
ENR SCHOOL*POVSCH	0.0002	0.0002	0.87	
R Squared	0.71			
F Value	128.92			

Table 17 (Cont.)

3. Elementary Schools

Regression 1 - Elementary Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.9	0.028	139.6	***
POVERTY	-0.015	0.0004	-36.31	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.68			
F Value	1318.76			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

Regression 2 - Elementary Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.94	0.045	86.69	***
POVERTY	-0.015	0.0005	-33.84	***
SCHOOL ENROLL	-0.0046	0.0004	-1.03	
DISTRICT ENROLL	-0.0003	0.00006	-0.58	
ENR SCHOOL*POVDIST				
ENR DIST*POV SCH				
ENR DIST*POV DIST				
ENR SCHOOL*POVSCH				
R Squared	0.69			
F Value	439.69			

Table 17 (Cont.)

Regression 3 - Elementary Schools

Variable	Parameter	Std. Error	t value	Significance
INTERCEPT	3.89	0.036	107.33	***
POVERTY	-0.014	0.005	-26.43	***
SCHOOL ENROLL				
DISTRICT ENROLL				
ENR SCHOOL*POVDIST	0.0001	0.0002	0.54	
ENR DIST*POV SCH	-0.000001	0.000003	-0.38	
ENR DIST*POV DIST	0.000002	0.000004	0.46	
ENR SCHOOL*POVSCH	-0.0002	0.0002	-1.2	
R Squared	0.69			
F Value	264.69			

It appears that, given poverty levels, high and middle school students tend to have higher achievement levels in smaller scale schools. This is not the case for elementary schools where the school enrollment parameter is negative though not statistically significant.

Turning to the **DISTRICT ENROLL** results in Table 17, it is noted that this district size variable is estimated to also have a negative impact on student performance. However, in no case is the impact observed to be greater than zero. Thus, at this level of analysis, it is observed that the size of school districts does not have a noticeable impact on student performance in South Carolina schools. This finding is consistent with much of the earlier literature on this subject. As a final observation on Regression 2, it can be noted that adding the district and school size variables to Regression 1 adds very little explanatory power to the model. This is noted by the small increase in the R squared value between the two regressions.

The last set of regression is presented as Regression 3 in Table 17. Here, the focus is on the hypothesized co-dependency between school/district size and socioeconomic status of students in terms of the impact on student performance. Thus, the two variables directly measuring school and district size are removed from the regression, and the four interaction variables discussed above are included. These results are labeled Regression 3 and the following discusses the results for each level of schools.

Starting with South Carolina high schools, it is noted that only one of the interaction variables is found to have a negative and significant impact on student performance. This is the ***ENR DIST*POV SCHOOL*** variable. This is the product of school district size and school poverty level. The negative sign on this parameter implies that poor schools (high poverty index) in small districts (small district enrollments) and well-to-do schools (low poverty index) in large districts (large district enrollments) tend to do better in terms of student performance. The negative value for the above combinations times the negative value of the parameter estimate yields a positive impact on the dependent variable or student performance. This finding is consistent with the findings in the literature. It thus appears that for South Carolina high schools, smaller school districts are more conducive to student achievement for schools containing low socioeconomic students or high poverty index values, while larger districts generate higher achievement levels for schools with low poverty levels.

Turning to the results of estimating Regression 3 for South Carolina middle schools, one finds a more robust set of results for the set of interaction variables. To begin, the parameter estimates for both ***ENR SCHOOL*POV DIST*** and ***ENR DIST*POV SCHOOL*** are both negative and test to be significantly different from zero in terms of their impact on student performance. The interpretation of the first variable is that small schools in poor districts and large schools in more well to do districts tend to have a positive impact of school performance. This is consistent with the anticipated relationship between scale and socioeconomic conditions. The negative and significant results for the ***ENR DIST*POV SCHOOL*** variable has been described in the above paragraph for high schools. That is, poor schools tend to do better in small districts while schools with less poverty do better in larger school districts. It is thus apparent that for South Carolina middle schools, the impact of school or district size on student performance depends upon the socioeconomic status of the student being served.

The third interaction variable found to have a significant impact on student performance is ***ENR DIS*POV DIST***. The interaction here is between enrollment and poverty at the school district level. As observed in Regression 3 for middle schools, the parameter for this variable is estimated as positive and significantly different from zero. The interpretation of this results is a bit more difficult that the above. First, the positive sign would imply that small, low poverty level districts, and large, high poverty level districts tend to foster greater student achievement. While this may seem inconsistent with the above discussion, it could very well be that a number of well to do smaller school districts with high achieving students are driving the results through this variable. Such an interpretation is reasonable and not inconsistent with the results for the two interaction variables discussed in the preceding paragraph.

The final results for Regression 3 is for South Carolina elementary schools. This is the last box of results under Regression 3 in Table 17. As can be seen, none of the interaction variables are found to have a significantly different from zero impact on student achievement for this class of schools. *It thus appears that the relationship between size, socioeconomic status, and student performance is operative only at the middle and high school level.*

D. Conclusion

The purpose of this section is to examine the relationship between size or scale of operation (school and district size) and student achievement. An extensive data set for all South Carolina elementary, middle, and high schools was utilized to test a number of hypotheses concerning these relationships. Utilizing basic linear regression techniques, it was first observed that given the school poverty level (a measure of socioeconomic status of the students) that for middle and high schools, students tended to have higher achievement levels the smaller the size of schools. This was not the case for elementary schools. No significant relationship was found between school district size and student performance at any school level.

Some interesting results were found in testing for the interrelationship between school and district size, poverty levels, and student performance. In general, the hypothesis generated from the literature that smaller scale tends to be more effective in promoting student achievement for low socioeconomic student populations while large scale is better for higher income populations was generally confirmed for middle and high schools in South Carolina. The reason for this may be that larger districts provide resources for a diversified curriculum that provides benefits to high socioeconomic student populations. Smaller districts may not be able to provide such variety but provide education at a scale more appropriate for students in lower socioeconomic areas.

Thus, the issue of an appropriate size school or school district for promoting student achievement is a more complex question than would appear at first glance. The real question is what is the appropriate size for whom? The above results at least begin to answer this question.

6. School District Size and Financial Efficiency

A. Introduction

As previously noted one of the issues being examined in this report is the relationship between school district size and teaching costs and non-teaching costs. The literature review in Section 3 pointed to the evidence that "scale economies" exist in the provision of public education such that unit costs do tend to decrease as scale or size increases. The simple economic explanation of this finding is that certain costs are given or fixed and as output (number of students) increases, these fixed costs per unit would tend to decline.

In this section of the report we look at the relationship between school district size and financial efficiency with efficiency being defined as the cost of providing services. The idea is that as the size of the operating unit (in this section the district) increases the cost

of providing services decreases. These economies of scale can probably be traced to two primary factors. The first could possibly be seen in the purchase of supplies and materials. It is reasonable to assume that the larger districts would obtain lower costs for supplies and materials due to volume purchasing. The second factor is perhaps the more important one. Larger districts would be expected to have lower per pupil cost because of the mix between variable and fixed cost. A good example of this can be seen in the cost of the chief administrative officer in a district. Each district regardless of size is required to have a certified superintendent. As the number of students in the district increases this fixed cost declines on per pupil basis. Naturally, this is an over simplification because there are many offsetting situations; however, this factor to some degree impacts the cost of educational services.

The question is then, does the district level aggregated data for student cost reveal any evidence that such size economies exist for South Carolina's school districts?

B. Methodology

We have taken two approaches to evaluate the relationship between district size and financial efficiency in South Carolina. The first was to evaluate the data by cost categories in the In$ite database as reported to the State Department of Education. A number of years ago South Carolina installed a financial reporting system called In$ite in each school district in the state. This reporting system captures all district expenditures, regardless of source of funding, for a given year and distributes the cost into 30 different categories. While our level of investigation concentrated on the district, the In$ite reporting system provides financial information on the school level by using actual cost and attributed cost from the district. A second methodology incorporates regression analysis and analyses the non-instructional costs by district. The results of the regression analysis follows this discussion.

Since the concern in this study is the relationship between size and cost, it is not necessary to undertake an analysis at the detail level of the 30 categories. Our objective can be accomplished by analyzing the cost data at the more manageable level of the five major functions. Table 18 lists the In$ite categories in each functional area.

Table 18
In$ite Functional Categories

Major Function	Sub-Function	Detail Function
Instruction	Face-To-Face Teaching	Instructional Teachers Substitutes Instructional Paraprofessionals
	Classroom Materials	Pupil-Use Technology & Software Instructional Materials & Supplies
Instructional Support	Pupil Support	Guidance & Counseling Library & Media Extracurricular Student Health Services
	Teacher Support	Curriculum Development In-Service & Staff Training
	Program Support	Program Development
Therapists, Psychologists, Evaluators, Personal Attendants & Social Workers		
Operations	Non-Instructional Pupil Services	Transportation Food Services Safety
	Facilities	Building Upkeep & Maintenance
	Business Services	Data Processing Business Operations
Other Commitments Contingencies	Budgeted Contingencies	
	Capital	Debt Service Capital Projects
	Out-Of-District Obligations	Parochial, Private, Charter, & Other Pass Through Retiree Benefits & Other
	Legal Obligations	Claims & Settlements

Leadership	School Management	Principals & Assistant Principals School Office
	Program Management	Deputies, Senior Administrators, Researchers & Program Evaluators
	District Management	Superintendent & School Board Legal

The latest In$ite data available are the results from school year 1999-2000. In our analysis the data under Sub-Function "Capital" has been excluded from the Other Commitments Functions and listed as a separate Function. The very nature of the expenditures for Capital calls for its exclusion in our analysis. These expenditures are very time related. Since in 1999-2000 depreciation allowance was not an expense item, the total cost of any capital expansion was expensed in the year it was paid. Additionally, payments for debt service are related to the timing of the last debt issue. To include such cost in the analysis would skew the data. While such cost are a real issue and will be reviewed in this study, they are not germane to our analysis. Likewise, the reported figures for the state on per pupil expenditures exclude the cost of debt service and capital projects.

C. Analysis

A statistical tool called the Pearson correlation was run on each functional category to determine its relationship with the size of districts. Table 19 presents the results of that analysis (See Appendix A for details).

Table 19

Functional Area	Mean	Correlation	Percent
Instructional	$3,819	-0.11738	58.1
Instructional Support	$ 839	-0.16111	12.8
Operations	$1,291	-0.19212	19.6
Other*	$ 2		.1
Leadership	$ 617	-0.37497	9.4
Total	$6,568	-0.23435	100.0
Capital	$1,432	0.10229	

*Correlation not meaningful since only 11 district had cost in this category

While none of the relationships between district size and the various functional cost areas are that strong, they all show a negative relationship. This supports the notion that in general larger districts operate at lower cost per pupil. As one would suspect the highest

correlation is between size and the cost of providing leadership which tends to be more of a fixed cost than a variable cost. It is interesting to note that the higher correlations are in the functional areas which have the least cost per pupil. The largest expense category, Instructional, which is over half the cost of services, has the smallest correlation.

Before leaving this analysis a correlation was run between the capital sub-function and size. It is the only category which has a positive correlation which means as the size increases the cost per pupil tends to increase. The Pearson correlation does not mean causal relationships between the variables. Since capital expenditures is time sensitive, it is probably safe to assume that the relationship is more than likely related to the larger districts doing more building right now than the smaller districts?

To get a better indication of how the size of the school district relates to the cost of providing educational services we grouped the districts by size and compared their average cost.

Table 20

Group	Number	Average Size	Average Per Pupil Expenditures	Ratio to State Average
25,000->	5	36,103	$6,345	1.001
15,000-24,999	6	17,506	$5,921	.934
10,000-14,999	7	12,227	$6,316	.996
5,000-9,999	21	7,570	$6,383	1.007
2,500-4,999	23	3,642	$6,477	1.017
0 – 2,499	24	1,478	$7,062	1.114
State Total	86	7,551	$6,338	1.000

The results in Table 20 illustrate that as districts decrease in size the cost of providing services increases. The only exception is in the group with the largest districts which has an average cost a little greater than the state average. The smallest district group is the only group which is meaningfully above the average state cost per pupil with a ratio of 1.114. This translates to an average cost per pupil of $724 more than the state average.

However, the apparent gains in efficiency are not totally consistent with larger districts. For example, if one looks at the individual districts in the group of largest districts (with over 25,000 pupils), there is a possible case for districts being too large (Table 21). That is, at some point, the gains in efficiency due to economies of scale may disappear and in fact, reverse themselves.

Table 21

District	Expenditures	Ratio to

Size		Per Pupil	State Average
1	58,019	$5,737	.905
2	42,738	$6,092	.961
3	27,282	$7,020	1.107
4	26,471	$7,858	1.240
5	26,007	$5,872	.926

Additional Evidence of Economies of Scale in South Carolina

In addition to the analysis above, the following section summarizes the results of regression analysis performed on the In$ite data to provide evidence on the existence of scale economies in South Carolina school districts.

The Data

Table 22 provides information on the variables to be used in this section. The data is at the school district level covering all school districts in South Carolina.[13] As with the section on student performance, the size variable used is total ***ENROLLMENT***. One again notes that district size varies greatly, from 396 students to 58,949 students (2002 data). The mean district contains 7,674 students.

As noted above, the In$ite data provided by the South Carolina Department of Education allows one to easily develop a set of per-student cost values that are close proxies to fixed and variable costs. Specifically, information is available on total cost per student for each district and then the percent of costs that cover the teaching function. Thus, it is possible to generated measures of teaching costs per student and non-teaching costs per student for each school district.

TEACHING COST/STUDENT and ***NON-TEACHING COST/STUDENT*** are the variables calculated to measure these two elements of district costs. It is of interest to note in Table 12 that the mean value for these two variables are almost identical with teaching and non-teaching costs averaging at $3,300 per student. The variation, however, is much greater for non-teaching costs. Here the range is from a low of $2,200 per student to nearly $6,000. Teaching costs range from $2,600 to $4,200 per student. The standard deviation for non-teaching cost is almost twice that for teaching costs.

TABLE 22

DESCRIPTIVE
STATISTICS

[13] Actually, information on Hampton District 2 was deleted because of some missing data. Thus, the total number of observations is 85.

SOUTH CAROLINA
SCHOOL DISTRICTS

VARIABLE	NUMBER OF OBSERVATIONS (a)	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
ENROLLMENT	85	7674	9183.1	396	58949
TEACHING COST / STUDENT	85	3314	339.9	2585	4211
NON-TEACHING COST/ PER STUDENT	85	3301	639.6	2247	5992

(a) Information on Hampton District 2 was deleted because of some missing data. Thus, the total number of observations is 85.

Regression Results

Table 23 provides the results of a simple regression exercise where teaching costs (both teaching and non-teaching) are regressed against district size (enrollment). The first set shows the results of regressing ***TEACHING COST/STUDENT*** against ***ENROLLMENT***. Regression 2 in the second set has ***NON-TEACHING COST/STUDENT*** as the dependent variable. Regression 3 includes *ENROLLMENTSQ* (Enrollment squared) as a dependent variable in the *NON-TEACHING COST/STUDENT* regression. The interest is, of course, whether or not district enrollment is a statistically significant factor in explaining variations in these two components of school district costs.

The results shown in Table 23 are as expected. If our ***NON-TEACHING COST/STUDENT*** measure is a proxy for the fixed cost component of student expenses, then larger districts should exhibit lower per-student values for this variable. As seen in Regression 2, this is indeed the case. The estimated parameter for ***ENROLLMENT*** is negative and statistically different from zero at the 5 percent level. It is noted that similar results are not found for the ***ENROLLMEN*** parameter in Regression 1. Here, the sign is negative but it does not show up as being statistically different from zero in its effect on the ***TEACHING COST/STUDENT*** variable.

Turning to Regression 3, it is observed that *ENROLLMENTSQ* is positive and significantly different from zero. This would imply that the relationship between *NON-TEACHING COST/STUDENT* and size is not linear, but suggests a "U-shaped" curve which is consistent with the existence of economies of scale.

Table 23

Regression Results

Enrollment Impact on Teaching and Non-teaching Costs

Regression 1

Variable	Parameter	Std. Error	t value	Significance
Intercept	23131	9731.7	2.3	**
ENROLLMENT	-4.66	2.92	-1.6	
R Squared	0.03			
F Value	2.55			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

Regression 2

Variable	Parameter	Std. Error	t value	Significance
Intercept	19609	5127.9	3.82	***
ENROLLMENT	-3.61	1.52	-2.37	**
R Squared	0.06			
F Value	5.61			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

Table 23 (cont.)

Regression 3 Non-Teaching Cost

Variable	Parameter	Std. Error	t-Value	Significance
Intercept	3581	111.6	32.08	***
ENROLLMENT	-0.50	.02	-2.88	***
ENROLLMENTSQ	7.6 (-7)	3.7 (-7)	2.07	**
R^2	.11			
F Value	5.05			

*** 1 Percent Level
** 5 Percent Level
* 10 Percent Level

D. Conclusion --- Financial Efficiencies

The purpose of this section was to examine cost data on school districts to determine if there was evidence of economies of scale for school districts in South

Carolina. The concept is that larger districts are able to distribute their fixed costs over a larger number of students thus lowering this component of their per-student costs. Using non-teaching costs as a proxy for fixed costs, the above regression results confirm this expectation. That is, the negative and significant sign for the enrollment variable's parameter indicates that the non-teaching cost per student tends to decline as district size increases.

It was further found that this relationship is strongest in the cost of providing leadership and operations services which both contain cost items which tend to be more fixed than variable. Grouping the districts by size illustrates that the concept of financial efficiency has its largest impact in the group with less than 2,500 students. However, this analysis also suggests that the reductions in cost per student may be lost when districts reach 25,000 pupils or more.

Does this mean that the taxpayers of the state have to pay a premium to operate small school districts? To put things in perspective, if one assumes that the school districts of the state could be combined to yield no districts of less than 2,500 pupils and that their cost of providing services came in line with the state average cost of $6,338 then the total educational cost for the state would be reduced by $25,688,968. While this is a large sum of money, it represents less than one percent (.6%) of the state educational cost in 1999-2000.

7. Summary and Recommendations

The purpose of this study was to analyze existing data to better understand the relationship between school district size in South Carolina and student performance and the cost of providing educational services.

Student Performance:

Analyzing student performance by simply looking at district size provides some insight but it is too simplistic of an approach to evaluate student performance. As most of the literature suggests, the influence of socio-economic status must also be included in the analysis to adequately address the relationship. In addition, the relationship between performance and size is not consistent for all schools. After all, there are tremendous differences in elementary, middle and high school students. The analysis undertaken in this study attempts to incorporate these differences in the evaluation.

For elementary schools, it does not appear that district size matters. However, based on this analysis, it appears that high school and middle school students tend to have higher achievement levels in smaller scale schools. It appears that for South Carolina high

school students, smaller school districts are more conducive to student achievement for schools containing low socioeconomic students or high poverty index values, while larger districts generate higher achievement levels for schools with low poverty levels.

However, this is not the case for all schools. Poor schools tend to do better in small districts while schools with less poverty do better in larger school districts. It is thus apparent that for South Carolina middle schools, the impact of school or district size on student performance depends upon the socioeconomic status of the student being served.

In general, the hypothesis generated from the literature that smaller scale tends to be more effective in promoting student achievement for low socioeconomic student populations while large scale is better for higher income populations was generally confirmed for middle and high schools in South Carolina.

Per Pupil Cost:

This study suggests that economies of scale do exist in South Carolina school districts. Analyses of Pearson correlation and regression analysis methodologies both indicate that a non-teaching cost per student tends to decline as district size increases.

It was further found that this relationship is strongest in the cost of providing leadership and operations services which both contain cost items which tend to be more fixed than variable. By grouping the districts by size illustrates that the concept of financial efficiency has its largest impact in the group with less than 2,500 students. However, this analysis also suggests that the cost curve for South Carolina districts is "U-Shaped" (as the literature suggests) and that reductions in cost per student may be lost when districts reach 25,000 pupils or more.

Thus, the issue of an appropriate size school or school district for promoting student achievement and cost efficiency is a more complex question than would appear at first glance. The real question is what is the appropriate size for whom? The above results at least begin to answer this question.

Recommendations

The recommendations that follow must first be placed in the correct context. It must be remembered by policy makers when addresses issues concerning governance in South Carolina School Districts that there are few if any of the 85 districts in the state are the same. If nothing else, this study clearly underscores one of the most profound characteristics of South Carolina School Districts -- the high degree of diversity among our 85 districts and the state's 1,110 schools.

This diversity is evident in the performance of the districts as measured by the Report Cards. However, the wide variations in the districts are evident in many other characteristics. The following illustrate the magnitude of this diversity:

- The size of districts ranges from 396 to 58,949 students
- The physical size of the districts range from 48.6 to 1,226 square miles
- The density of the districts range from 3 to 182 students/square mile
- The change in student enrollment from 1990 to 2000 ranges from -59% to +65%
- The poverty levels of the districts range from districts with 18% of the students at the poverty level to districts that have 98% of the students at the poverty level
- The cost per student ranges from $5,330 to $9,024
- The student teacher ratio ranges from 7.8 to 23.9
- The racial composition ranges from 7.8% minority to 98%
- Average teacher salaries range from $31,068 to $41,919

- Number of schools per district varies widely. There are 17 districts with 1 elementary school and one with 50 elementary schools
- Average district enrollment in elementary schools ranges from 206 to 1,272
- Average district high school enrollment ranges from 190 to 2,533
- The ability of districts to support public education varies widely. The value of a mill of property tax ranges from $7,000 to over $1,200,000
- The percent of districts' budgets from local sources ranges from 14% to 80%

Given this tremendous diversity in the state's districts, we recommend that the Education Oversight Committee consider the following actions:

#1 Undertake an immediate effort to better educate the public, legislature and educational community of the wide diversity in the environment in which students in South Carolina schools learn. This diversity suggestions future state policies need to be well planned with a large degree of flexibility for different districts. It suggests that "one-size-fits-all" policies will meet with limited success across districts. Policies need to be designed with the demographic make-up of districts in mind.

#2 It is apparent that poorly performing schools do not have resources to allocate to instruction and teachers' continuing education. This is evidenced by a lower percentage of teachers with advanced degrees as compared to the higher performing districts. The great disparities that exist throughout the state constitute a spatial inequality that results in a situation where a student's opportunity to achieve is directly related to where his or her parents resides. It can be argued that it is a responsibility of government to provide for social justice and attempt to level the playing field. It is also clear that the existing conditions are likely to continue in the same directions. The demographic trends in South Carolina are directly influenced by the quality of schools. The more mobile sectors of the population will continue to migrate to better performing districts and support public education. At the same time, poorly performing districts are going to continue to have declining enrollments and the local tax bases will continue to erode. There is an urgent need for the state to allocate additional state resources to poorly performing districts. These are generally from poor, low-density school districts with little local ability to generate substantial local funds (indicated by relatively low tax bases).

#3 Any proposal designed to reduce operational costs through consolidation of smaller districts needs to be carefully evaluated to ensure there are no indirect impacts on performance and increased transportation costs.

#4 Due to the tremendous diversity in the 85 districts and among the districts themselves, consider modifying the classification system for Report Card grades for districts. For example, the larger the district, the less meaningful a district-wide grade becomes. If a district has 30 or 40 schools and there exists a wide diversity among those schools, one district-wide grade is a relatively poor indicator of performance for all schools and all students in the district. One alternative would be to eliminate district-wide grades and focus on school-level performance. Another alternative would be to expand the grading system among like schools within a district, etc.

#5 Revisit for possible reevaluation the state funding formula for districts --- especially for those districts that are poor and low-density. Factors such as density should be reviewed for inclusion in the formula funding procedure.

#6 More teachers with more advanced degrees need to be attracted to the poorly performing districts. The state needs to allocate additional resources to encourage teachers with more advanced degrees to the poor, low-density districts.

#7 Undertake an evaluation of the professional development and distance learning opportunities and incentives for teachers in poorly performing districts, especially for those districts that are relatively poor in terms of tax base, low densities and higher proportion of students living in poverty.

Appendix A: IN$ite Expenditure Data by District For 1999-2000 with Summary Statistics

District	ADM	Instr	Instr Sup	Operation	Other	Leadership	Total	Capital
Abbeville	3816	$3,883	$748	$1,257	$0	$508	$6,396	$441
Aiken	24118	$3,414	$623	$946	$0	$436	$5,419	$1,029
Allendale	1947	$4,804	$950	$1,985	$0	$1,014	$8,753	$356
Anderson 1	7034	$3,066	$772	$864	$0	$429	$5,131	$604
Anderson 2	3507	$3,787	$688	$1,061	$0	$591	$6,127	$230
Anderson 3	3565	$3,264	$741	$1,051	$0	$467	$5,523	$386
Anderson 4	2492	$3,559	$744	$1,151	$0	$448	$5,902	$1,254
Anderson 5	10907	$3,797	$900	$1,290	$0	$445	$6,432	$759
Bamberg 1	1772	$3,588	$678	$1,230	$0	$825	$6,321	$466
Bamberg 2	1107	$4,659	$1,072	$1,861	$0	$1,115	$8,707	$614
Barnwell 19	1049	$4,444	$873	$1,411	$0	$908	$7,636	$5,749
Barnwell 29	1021	$3,625	$798	$1,468	$4	$742	$6,637	$287
Barnwell 45	2744	$3,809	$534	$1,012	$0	$566	$5,921	$606
Beaufort	15913	$3,896	$959	$1,437	$0	$623	$6,915	$3,234
Berkeley	26007	$3,505	$693	$1,216	$0	$458	$5,872	$705
Calhoun	2049	$4,339	$1,047	$1,454	$30	$804	$7,674	$975
Charleston	42738	$3,709	$704	$1,163	$0	$516	$6,092	$2,017
Cherokee	8625	$3,729	$708	$1,269	$0	$552	$6,258	$1,671
Chester	6616	$3,744	$676	$1,086	$0	$522	$6,028	$772
Chesterfield	7908	$3,710	$852	$1,131	$0	$561	$6,254	$721
Clarendon 1	1270	$4,453	$1,085	$1,403	$0	$881	$7,822	$1,477
Clarendon 2	3520	$3,658	$668	$952	$0	$454	$5,732	$1,937
Clarendon 3	1159	$3,055	$794	$1,137	$0	$647	$5,633	$297
Colleton	6785	$3,698	$757	$1,326	$0	$701	$6,482	$178
Darlington	11021	$3,872	$831	$1,282	$0	$564	$6,549	$461
Dillon 1	912	$3,769	$690	$1,092	$0	$639	$6,190	$247
Dillon 2	3809	$3,152	$698	$1,257	$0	$517	$5,624	$924
Dillon 3	1468	$3,378	$798	$1,169	$55	$646	$6,046	$162
Dorchester 2	16367	$3,519	$666	$1,006	$0	$411	$5,602	$731
Dorchester 4	2401	$4,254	$1,009	$1,425	$0	$816	$7,504	$1,854
Edgefield	3990	$3,711	$884	$1,453	$0	$677	$6,725	$532
Fairfield	3635	$4,675	$95	$1,935	$0	$855	$7,560	$1,059
Florence 1	13924	$3,411	$681	$981	$0	$488	$5,561	$416
Florence 2	1121	$3,727	$607	$1,068	$0	$544	$5,946	$3,247
Florence 3	4287	$3,481	$769	$1,459	$0	$741	$6,450	$933
Florence 4	1108	$3,813	$843	$1,767	$0	$857	$7,280	$6,895
Florence 5	1443	$3,687	$918	$1,238	$0	$612	$6,455	$729
Georgetown	10181	$4,240	$865	$1,570	$0	$778	$7,453	$6,651
Greenville	58019	$3,436	$701	$1,067	$17	$516	$5,737	$2,604
Greenwood 50	8561	$3,821	$930	$1,089	$0	$514	$6,354	$487
Greenwood 51	1214	$3,756	$968	$1,334	$0	$737	$6,795	$404
Greenwood 52	1590	$3,609	$892	$942	$0	$649	$6,092	$231
Hampton 1	2712	$4,122	$735	$1,067	$0	$779	$6,703	$321

District	ADM	Instr	Instr Sup	Operation	Other	Leadership	Total	Capital
Hampton 2	1456	$3,576	$1,018	$1,752	$0	$833	$7,179	$279
Horry	27282	$4,151	$894	$1,401	$3	$571	$7,020	$976
Jasper	2795	$3,714	$848	$1,687	$9	$563	$6,821	$806
Kershaw	9573	$3,587	$807	$1,417	$0	$546	$6,357	$565
Lancaster	10786	$3,672	$696	$1,154	$0	$530	$6,052	$1,247
Laurens 55	5846	$3,640	$717	$1,036	$0	$612	$6,005	$1,086
Laurens 56	3508	$3,438	$721	$746	$0	$685	$5,590	$714
Lee	3006	$3,944	$936	$1,401	$0	$641	$6,922	$3,006
Lexington 1	16351	$3,354	$740	$998	$1	$324	$5,417	$1,136
Lexington 2	8912	$4,151	$1,000	$1,184	$0	$518	$6,853	$1,235
Lexington 3	2277	$4,049	$1,055	$1,363	$9	$739	$7,215	$1,819
Lexington 4	3105	$3,254	$1,051	$1,314	$0	$536	$6,155	$2,364
Lexingtin 5	14424	$3,904	$1,001	$953	$0	$466	$6,324	$1,428
McCormick	1187	$4,007	$1,504	$2,375	$0	$1,135	$9,021	$101
Marion 1	3268	$3,663	$761	$1,151	$6	$422	$6,003	$797
Marion 2	2273	$3,617	$1,501	$1,319	$0	$527	$6,964	$584
Marion 3	615	$4,325	$986	$1,871	$0	$860	$8,042	$424
Marion 4	443	$4,246	$1,026	$1,605	$0	$1,191	$8,068	$533
Marlboro	5325	$3,430	$728	$1,197	$0	$589	$5,944	$623
Newberry	5719	$3,858	$865	$1,412	$0	$637	$6,772	$548
Oconee	9982	$4,241	$919	$1,423	$0	$631	$7,214	$1,468
Orangeburg 3	3922	$4,073	$870	$1,471	$0	$686	$7,100	$1,364
Orangeburg 4	4152	$4,000	$838	$1,368	$0	$531	$6,737	$3,251
Orangeburg 5	7623	$4,060	$1,395	$1,378	$0	$628	$7,461	$638
Pickens	15612	$3,528	$682	$1,033	$0	$427	$5,670	$1,009
Richland 1	26471	$4,509	$1,039	$1,680	$0	$630	$7,858	$3,754
Richland 2	16680	$3,923	$773	$1,522	$0	$525	$6,743	$955
Saluda	2108	$3,948	$799	$1,308	$43	$805	$6,903	$4,525
Spartanburg 1	4205	$3,875	$793	$1,111	$0	$449	$6,228	$1,075
Spartanburg 2	7576	$3,257	$604	$1,038	$0	$431	$5,330	$534
Spartanburg 3	3232	$4,074	$1,141	$1,365	$0	$634	$7,214	$886
Spartanburg 4	2791	$3,280	$698	$1,007	$0	$538	$5,523	$1,823
Spartanburg 5	5351	$4,161	$804	$1,018	$0	$488	$6,471	$1,949
Spartanburg 6	8785	$3,725	$655	$942	$0	$454	$5,776	$1,576
Spartanburg 7	8909	$5,036	$1,110	$1,503	$0	$618	$8,267	$9,193
Sumter 2	9446	$3,521	$837	$1,230	$0	$485	$6,073	$942
Sumter 17	8979	$3,556	$843	$1,198	$0	$459	$6,056	$1,615
Union	4956	$4,245	$898	$1,169	$0	$537	$6,849	$282
Williamsburg	6408	$3,364	$934	$1,272	$0	$526	$6,096	$496
York 1	4847	$3,791	$712	$1,136	$0	$565	$6,204	$942
York 2	4408	$4,632	$904	$1,642	$0	$657	$7,835	$4,095
York 3	14346	$3,700	$720	$1,231	$15	$503	$6,169	$1,612
York 4	5011	$3,699	$672	$1,284	$0	$425	$6,080	$3,322
Sum	649383	$328,406	$72,139	$111,027	$192	$53,110	$564,874	$123,230
Average	7550.965	$3,819	$839	$1,291	$2	$618	$6,568	$1,433
STD	9020.200	$395	$195	$277	$8	$170	$830	$1,594
Pearson		-0.117378	-0.16111	-0.192115	0.0233	-0.374976	-0.234	0.1023

APPENDIX B. IBLIOGRAPHY

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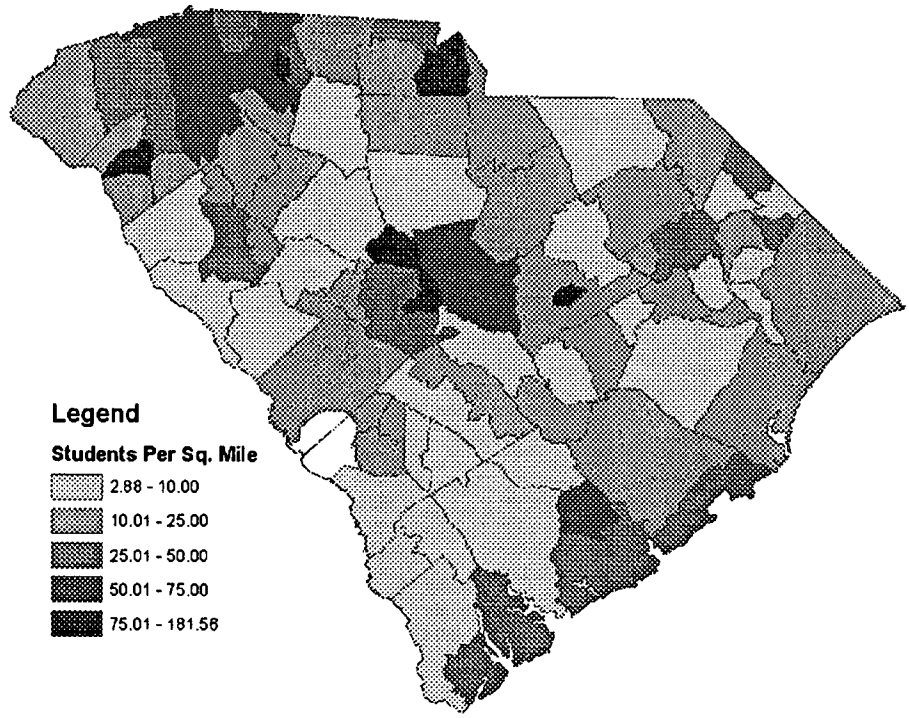
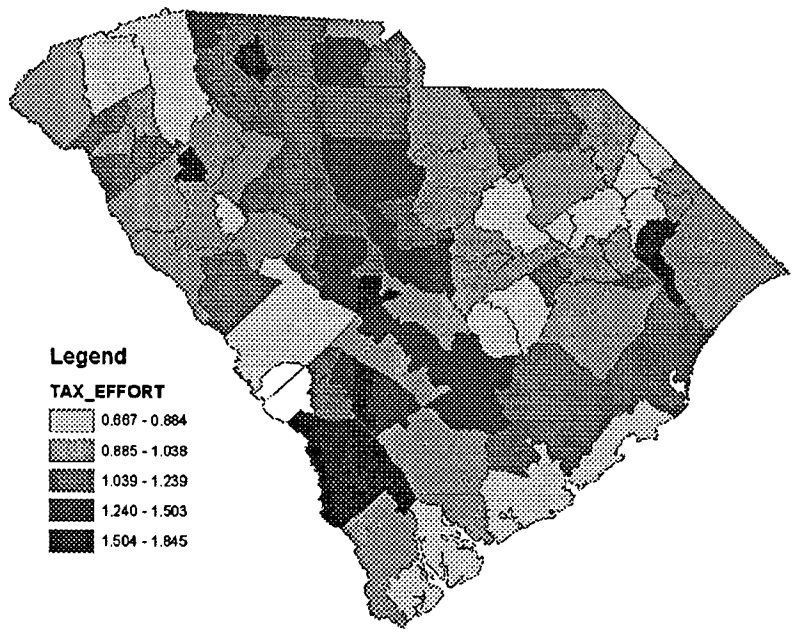
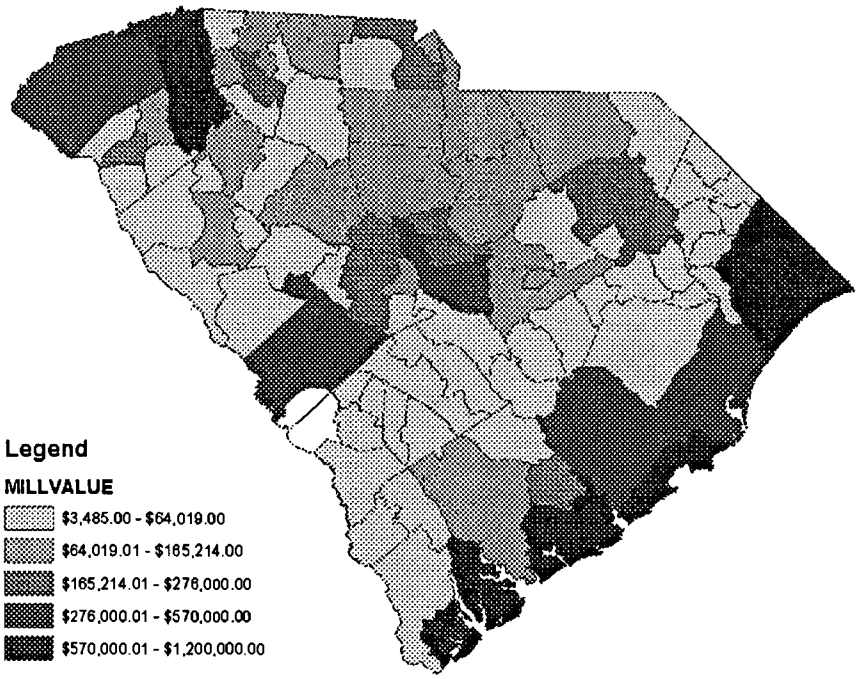
Appendix C– Additional maps



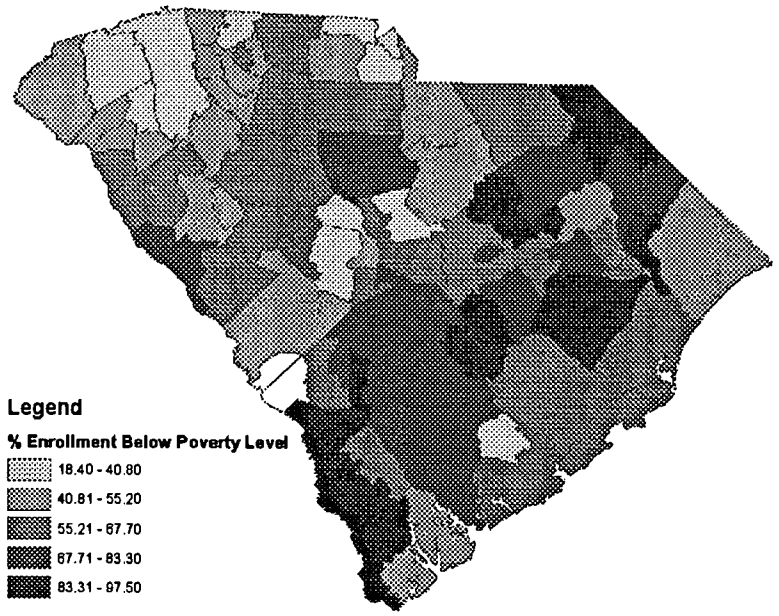
Map 8. Density of students per square mile



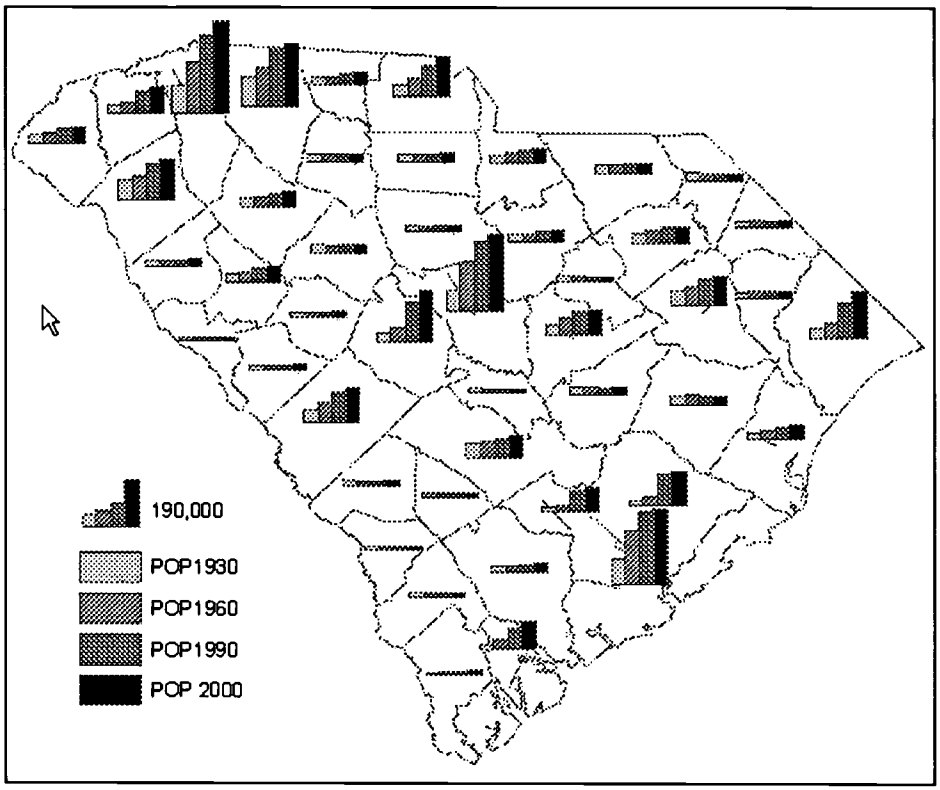
Map 9 Local tax effort, index of 1.0 represents the state average.



Map 10. Revenue generated from one mill of local property tax



Map 11. Percent of enrollment below poverty level.



Map 12 County level population change since 1930

Total Printing Costs..... $1,790.50
Units Printed..... 350
Cost Per Unit..... $5.12

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