

2004

Economies of size and implications for consolidation: a case study of Iowa school districts

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**Economies of size and implications for consolidation: a case
study of Iowa school districts**

by

Brandon James Repp

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

Major: Economics

Program of Study Committee:
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Ames, Iowa

2004

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This is to certify that the master's thesis of

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has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy

Dedication

For Lisa, whose love and support made all of this possible.

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Abstract

The state of Iowa is currently faced with many budget difficulties. Due to the fact that education accounts for nearly half of all state appropriations and nearly half of the property taxes paid in the state, ways of decreasing educational costs may contribute to relieving the current fiscal stress. The aim of this paper is to develop a model from past analyses to test for the presence of economies of scale in Iowa school districts. The results reveal average benefits from a cross section of Iowa school districts that may be realized through administrative consolidation of districts with less than 600 students. It is recommended that school officials also consider the average costs associated with school consolidation before recommending its use. This study is the first step in evaluating the possibility of statewide benefits through consolidation efforts.

Introduction

Education is a valuable and costly part of any community in the United States. One need only look at the support given to educational services around the country to see the sizeable financial dedication divested in schools. This is certainly true for the state of Iowa. For the 2005 fiscal year, appropriations from the state of Iowa General Fund to Iowa school districts account for \$4,464.2 million, or 45.4 % of total appropriations (<http://www.state.ia.us/educate/oofd/doc/facts040809.pdf>). The financial commitment to education in the state is enormous.

As with many other states, Iowa has experienced budget difficulties in recent years. In an attempt to explore efforts to relieve fiscal stress, education has been the focus of many state government investigations designed to promote economic efficiency in local schools. Many studies have focused on the presence of economies of scale in public education, attempting to find cost-minimizing enrollments for school districts. These past analyses have helped to promote or reject the consolidation of school districts, either through dividing responsibilities by grade (whole grade sharing), sharing administrative staff and services, or through combining entire school districts and student bodies in the affected schools.

The aim of this paper is to develop a model based on past analyses to test for the presence of economies of scale in Iowa school districts. Based on these findings, recommendations will be made regarding appropriate types of consolidation to be considered to decrease districts' costs. Further explanation of economies of size will be provided in following sections.

Education in Iowa

In Iowa, state aid plays the largest role in education funding, with 60% of local school district revenue coming from the state. Besides state aid, local property and other taxes provide the bulk of the remaining school district revenue. Approximately 33.9% of the total revenue of Iowa's school districts came from local taxes in 2002-2003. This amounts to roughly \$1.2 billion, about 44% of all state property taxes.

The impact of local revenue support is obvious. Iowa continues to have one of the slowest population growth rates in the nation. Although Iowa has experienced a small statewide population increase during the 1990's (1.7%), over half of Iowa's counties have lost population during the same time period. The population remaining in these primarily rural counties is concentrated in the elderly. These demographic changes coupled with the fiscal strains for state and local government make public service provision challenging.

For example, a recent report on rural education issues highlights some of the challenges of providing quality education in this environment. Thirty-three of Iowa's 370 school districts have fewer than 250 students. Projections of changes in the demographic composition for rural areas suggest that this situation is likely to continue. This demographic raises both financial and educational quality concerns. These budget issues increase the difficulty of retaining quality teachers in smaller schools. Despite the presence of lower student-to-teacher ratios in smaller schools, the quality of education provided in these schools may diminish.

Choosing how to deal with these changes is a very important local concern and a process that requires access to good information. The Iowa Department of Education website offers information on school district performance based on school size, geography, or other

criteria. This data from the Iowa DOE will be used to explore the potential cost savings from the consolidation of small Iowa school districts. The possibility of scale economies in public education has been the impetus for a litany of research on school consolidation. The analysis presented in this paper is derived from the efforts of researchers analyzing numerous states, spanning over several decades.

While the aim of this paper is to explore possible cost savings from consolidation, it is in no way a direct approbation for consolidation. The importance of education to the state of Iowa both financially and socially demands the active exploration of all tools to promote efficient use of limited funds. Consolidation is one such tool that should be considered and researched.

In the first section of the following paper, we introduce a theoretical framework for exploring cost savings based on models developed by noted authors in consolidation research. In the next section, the model is then applied to Iowa's school districts, with appropriate changes made. Finally, based on the resulting case study and noted savings potential, recommendations are offered regarding consolidation.

Education Production

Modeling the education process is a complicated task. A significant number of studies have been conducted in various states to determine the potential cost savings from consolidation. Fox (1981) conducted a thorough review of consolidation studies written by that time. His main criticism of these studies was a lack of a “theoretical base” (p.273), which contributed to inconsistent results across the studies. Andrews, Duncombe, and Yinger (2002) continued the work Fox began with their own review of contemporary consolidation literature. In an effort to provide a sound conceptual framework and avoid biased results, this paper offers a theoretical framework adopted by authors of no less than ten notable consolidation studies. This methodology is outlined by Andrews, Duncombe, and Yinger (2002), and fully elicited below.

Many studies rely on the use of economic production theory to model education, with appropriate modification. School districts, like private firms, use various inputs to produce educational activities. The production function for a school district can be modeled as the following:

$$A = f(X), \tag{1}$$

where A represents educational activities (educational output) and X is a vector of factor inputs including teachers, support staff, capital equipment, materials, utilities, and other relevant resources employed in the education process.

The appropriate measure of output for this production function would be in physical units (as in the number of cars produced by an automobile company). However, with

education, it may be both difficult and inappropriate to measure output in this manner. Rather than the number of activities that are being undertaken, the output of importance in education is accomplished proficiencies. Test scores are usually assumed to approximate the learning that occurs in schools and are therefore the primary concern of students and parents. To families and the general public, the utilization of inputs to simply create educational activities is a periphery concern compared to successful student learning. Duncombe, Miner, and Ruggiero (1995) contribute this concept of distinguishing activities produced by a government entity from actual services consumed by a citizen to that of Bradford, Malt, and Oates (1969).

Student achievement is largely, but not completely, dependent upon the educational activities provided by a school district through purchased inputs. Hanushek (1986) notes the importance of non-purchased inputs, “environmental” factors that affect the transformation of activities into student achievement. Environmental factors (E) used in studies often include physical characteristics of schools, most notably the total enrollment of students (N), the family backgrounds of students (F), and student characteristics (SC). In addition to environmental factors, student achievement is also impacted by unobservable effects. These unobservable effects (e) may include, but are not limited to, parent involvement in a child’s education, the social and interactive environment provided in a school, and the associated mindset of students when undertaking educational activities. Further explanation of the environmental factors considered in this study will be provided in the “Data and Estimation” section. Student achievement (S) can be modeled as a function of educational activities (classroom activities) and environmental and unobservable factors;

$$S = h (A, E, e), \quad (2)$$

S = student achievement
A = educational activities
E = environmental factors
e = unobservable effects

where,

$$E = g (N, F, SC), \quad (3)$$

N = total enrollment
F = family backgrounds
SC = student characteristics.

Substitution leads to an educational production function for educational service outcomes (student achievement):

$$S = h (A, g (N, F, SC), e) \quad (4)$$

Education production models of the type described above are widely used in consolidation literature. The use of this type of model to explore economies of scale relies upon adequate data on student achievement and quantity and quality of educational inputs under consideration. It is for the latter reason that a model of education production as above is not utilized in this paper. A considerable lack of adequate data on capital expenditures, school materials, utilities, and other inputs for Iowa school districts necessitates the use of an alternative education model. In essence, there is not enough data to accurately estimate the educational activities (*A*) in the model. Many researchers who have experienced similar difficulty in gathering adequate data on resources used in education activities have modeled educational production using cost functions. The model described above will be used to

develop such a cost function, which can more appropriately represent the case of Iowa educational production based on available data.

The total costs (TC) for a school district of producing a given level of student achievement are a function of the educational activities undertaken (A) and the resource prices of inputs used (P):

$$TC = j(A, P) \tag{5}$$

In order to utilize a cost-function approach to modeling education, we solve equation (4) for A and substitute into equation (5) to yield the following:

$$TC = j(h^{-1}(S, F, SC, N, e), P) = k(S, F, SC, N, e, P). \tag{6}$$

Equation (6) serves as the theoretical basis for estimating educational production. The use of this ideal model is contingent upon the availability of quality data on each of its variables. A discussion follows outlining the changes made to this model to adequately represent education production in the state of Iowa.

In the words of Duncombe, Miner, and Ruggiero (1995), “As applied to local schools, the term ‘costs’ refers to the amount of expenditure or outlay needed by a district to provide specified levels of educational attainment or outcome and not actual observed expenditure. In other words, costs are the value of the resources consumed in the production of a given level of student achievement.” While information on actual costs of education production is often scarce, data on actual expenditures is usually available. Many studies on

consolidation will use actual reported expenditures as a proxy to represent costs. One must consider inefficiencies in school district spending, however. In addition, it is important that the distinction be made between the costs of educational outcomes and actual expenditure, which may reflect the demand for education of citizens in a particular district. In other words, more revenue may be expended by a district than a particular level of student achievement requires simply because the district has more revenue available. This idea of considering demand in the district can arise for any public good or service, where the public may drive both the supply (through amount of taxes provided to the government) and the demand (through community preferences reflected in fiscal support).

Fox (1981) initially recommended including a measure of demand in the education process to explain the differences between costs (the ideal dependent variable) and actual expenditure (used as a proxy for the dependent variable). Among others, Duncombe, Miner, and Ruggiero (1995) use a measure of “fiscal capacity” in their analysis of New York public school district consolidation. In that study, the fiscal capacity of a school district reflected a weighted average of property wealth and adjusted gross income, which was then used in state aid formulae. This fiscal capacity measurement was used to stress the differences between the amount of revenue available from one school district to the next based on the wealth and income of the citizens of each district.

While differences in property wealth do factor into funding of Iowa school districts, their significance is decreased due to the fact that state aid transfers beyond property taxes are adjusted to match district revenue from property taxes, with both funding sources adding to a prescribed target. The passing of local option sales taxes may contribute to the apparent differences one sees in per pupil expenditure from one district to another. These differences

may also be explained by unspent balances from previous years' budgets and supplementary funding (both state and federal) for special projects such as infrastructure renewal and special education programs. A guide to the basics of education funding in Iowa written by Larry Sigel, the School Finance Director for the Iowa Association of School Boards, can be found at (<http://www.state.ia.us/tax/taxlaw/PTC-schoolaid1.pps>).

There are no apparent fiscal capacity effects present in the state of Iowa, although education preferences of school districts may be revealed through the presence or absence of local option sales taxes. Without knowing the rationale behind the choice to levy local option sales taxes, we cannot estimate the effect of demand on reported expenditures. Therefore, we cannot readily differentiate between reported educational expenditures and the actual costs of educational activities. As a result, per pupil expenditure will be used as a proxy for costs in this paper. Hence, equation (6) is modified to reflect the use of expenditures instead of costs:

$$EX = k (S, F, SC, N, e, P) \quad (7)$$

Economies of Size

The goal of this paper is to determine the potential cost savings (henceforth, expenditure savings) from the consolidation of Iowa school districts. At the heart of the matter is determining if economies of scale exist for education production. In the case of education, economies of size are explored, economies of size being "the elasticity between per pupil expenditures (EX/N) and enrollment N , controlling for student achievement S and

socio-economic cost factors, E'' (Andrews, Duncombe, and Yinger, 2002). This elasticity may be written as the following (Duncombe and Yinger, 1993):

$$\frac{d(EX/N)}{dN} \cdot \frac{N}{(EX/N)} = (dEX/dA)(A/EX) \cdot (dA/dN)(N/A) - 1 = \alpha_1 \alpha_2 - 1.$$

In this expression, economies of size exist if per pupil expenditure is decreased when student enrollment increases (as in consolidation). The above expression is less than zero when economies of size persist.

A further explanation of each of the above elasticities, α_1 and α_2 , is given here, as posited by Andrews, Duncombe, and Yinger (2002):

The first elasticity, α_1 , is technical economies of scale representing the relationship between expenditures and the quantity of school activities, and is the parallel cost concept to technical returns to scale. Defining the output of schools as lessons, technical economies of scale would exist if the expenditure per lesson decreased as the number of lessons provided by a school increased, or equivalently a 1 percent increase in school inputs leads to a more than 1 percent increase in lessons in constant quality.

The second elasticity, α_2 , “measures the degree of congestion or indivisibility that exists for school resources, and is expected to be greater than or equal to zero” (Andrews, Duncombe, and Yinger, 2002). For example, large schools may be able to more efficiently use specialized labor and facilities, such as math and science teachers and computer and

science labs (Tholkes 1991). Administrative costs may also be indicative of this type of decreasing costs. Administrators and support staff such as counselors can be shared among a large number of students, resulting in a decrease in per pupil expenditures as the number of students enrolled increases (Andrews, Duncombe, and Yinger, 2002).

Building from the theoretical model above and utilizing the definition of economies of size, the next section applies the previous framework to data on Iowa school districts, beginning with an explanation of the data used and ending with implications of the model's results.

Data and Estimation

The data used for this report was gathered from the Iowa Department of Education website. Information regarding students, teachers, enrollments, expenditures, and resource prices were gathered from the appropriate spreadsheets available at <http://www.state.ia.us/educate/>. The availability of data on each of Iowa's 370 school districts has made a report of this nature possible. However, the lack of adequate data from the current year has led to the use of data from previous years. The respective years' data for each variable is reported below. With more complete data sets, studies of this type will increase in quality.

The following is a listing of the variables considered in this model and the corresponding data that was collected.

Student Achievement

The measurement used for student achievement is derived from data found on the Iowa Department of Education website under the link "School Profiles" (<http://www.iowaschoolprofiles.com/>). Iowa students in elementary and middle schools are administered the Iowa Test of Basic Skills (ITBS), while high school students are administered the Iowa Test of Educational Development (ITED). The percentage of students deemed "proficient" in reading and math for each school district is provided under the school profile link. A student is considered proficient if he/she has scored in the range of 41-99 using the national percentile rank scale. A more complete description of proficiency is included under the section "Student Performance" in "The State Report Card for No Child

Left Behind” (<http://www.state.ia.us/educate/ecesc/nclb/doc/reportcard04.pdf>). For each of the grades 4, 8, and 11, the percentages of reading proficiency and math proficiency were averaged to create a combined proficiency score for that grade, using combined data from the 2001-2002 and 2002-2003 school years. The three grade level scores were then averaged to make an overall score to reflect the proficiency of students for a particular school district. Districts that did not have proficiency scores for one or more of the grade levels, due to grade sharing with neighboring districts or reorganization around the time of the original data collection, were still used in this study. The exceptions to this, however, were two districts that had no available proficiency data and were subsequently dropped from the empirical analysis.

In addition to percentages of proficient students in reading and math, data was also provided on the percentage of students tested at each grade level in each subject for all of the districts. Without sufficiently high participation rates, it is difficult to gain a true sense of student achievement in a district. For this reason, any school district with a participation rate below that of 95% was dropped from the analysis. Of the 370 Iowa school districts, 27 had participation rates below 95%. After removing the two districts with no proficiency data and the 27 districts with insufficient participation rates, 341 Iowa school districts were used for the empirical analysis. Several of the school districts dropped from this analysis were those with the largest enrollment levels in the state.

In addition to proficiency rates, dropout rates were collected as another indicator of school district performance. This variable is often used in consolidation studies to cover a wider range of outcome measures than simply using test scores. A concern rises in the use of dropout rates, due to the idea that dropping out of school is a choice made by individual

students. This means that the dropout rate of a school district will not be entirely controlled by the district. However, it is important to use another type of performance measure in order to distinguish a separate way that achievement may affect expenditures. Dropout rates of all seventh through twelfth graders for each school district were collected from the 2002-2003 school year at (<http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04x.xls>).

Enrollment

Data collected on district student enrollment from 2003-2004 is used in this report (<http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04n.xls>). Total pre-kindergarten through twelfth grade enrollment, including special education students, has been chosen instead of district attendance rates. It is unclear whether or not reported attendance rates on the Iowa Department of Education website include special education students. These students are included as a part of this analysis, and therefore total enrollment is the favored measure. Although attendance rates are generally a better indicator of how many students are actually being served, the average attendance rate for the analyzed school districts is 95.8%, indicating that total enrollment is sufficient for estimating the number of students served.

Resource Prices

The only input containing adequate data on expenditures is that of teachers. The Iowa Department of Education website lists the number of full-time teachers, along with the average salary of full-time teachers, for each school district. Due to the fact that measures of

teacher salary are not adjusted for quality, included in this report is an index of teacher salaries. Using OLS, average full-time teacher salaries were regressed against average years of full-time teacher experience and the percent of full-time teachers with advanced degrees. Holding these factors at their mean values, the resulting residuals were used to show the differences in quality-adjusted teacher salary across school districts. Data on average full-time teacher salary, average years of full-time teacher experience, and the percent of full-time teachers with advanced degrees for the 2003-2004 school year was obtained from the Iowa DOE website at <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04u.xls>. More specifically, the regression used to obtain the adjusted teacher salaries index was the following:

$$\text{AveSal} = \beta_0 + \beta_1 * \text{TotExpr} + \beta_2 * \text{AdvDeg} + \epsilon, \quad (8)$$

AveSal = average full-time teacher salary

TotExpr = average full-time teacher total experience

AdvDeg = percent of full-time teachers with advanced degrees

ϵ = error term

The error term in the above regression may reflect any number of unknown factors affecting the average salary of full-time teachers in a school district. These may include the percent of male teachers in a district, the presence of teacher unions and their influence, and any cost-of-living adjustments made to teacher salaries. The regression results of equation (8) are listed in Table 1.

Environmental Factors

Regarding the family background of students, the only adequate data available from the Iowa Department of Education was that of poverty rates and the percentage of nonwhite students in each school district. The poverty rates compiled in this report reflect the percentage of all students in a district ages five to seventeen whose families are in poverty. This data comes from 2000, the most current census data available on poverty rates by school district (<http://www.census.gov/hhes/www/saipe/district.html>).

The percentage of nonwhite students is taken from data on district enrollment from 2003-2004 (<http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04n.xls>). Student characteristics for which data is available include the percentage of students who have limited English proficiency and the percentage of students that attend special education programs. Both sets of data come from 2003-2004, with the data on students with limited English proficiency originating at <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04s.xls> and data on special education students from <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04n.xls>.

Expenditures

Expenditure data was collected for the 2002-2003 school year from <http://www.state.ia.us/educate/fis/sft/car/doc/pfctegf03.xls> on the Iowa DOE website. This includes total per pupil expenditure, and per pupil expenditure in the categories of instructional, support services, administrative, operating and maintenance, and transportation.

Each category of expenditure will be used as the dependent variable in separate versions of the derived model.

Table 2 contains a breakdown of the 341 Iowa school districts used in this study, grouped in categories by enrollment. The intervals used are consistent with the literature on education production, for example, Knudsen's (1989) work on school consolidation. From Table 2, we can see that the smallest school districts (those with less than 250 students and also those with between 250 and 399 students) have the highest average in per pupil total expenditure, per pupil instructional expenditure, per pupil administration expenditure, and per pupil transportation expenditure, with these categories exceeding the state average by a sizeable margin (here "state average" refers to the 341 school districts used in the study). This presents the possibility of the existence of economies of size. It should be noted that several of the school districts originally dropped from this study because of lack of data were some of the largest in the state. It appears that these districts would have contributed to the lower average costs seen in the 7500+ category in regards to per pupil total, instructional, and administrative expenditures. Looking at student proficiency, the smallest school districts (those with less than 250 students) are slightly above the state average mark. The dropout rate for this size category of school districts is also the lowest by far (0.36 compared to the state average of 0.70).

The positive relationship between enrollment size and average teacher salary can be clearly seen in the data on teacher salary index. Small school districts pay a considerably lower proportion (0.86) of the quality-adjusted state average, compared to that of the largest schools (1.24).

A downward trend is evident in the characteristic of poverty rate. As district enrollment increases, the average poverty rate becomes progressively lower, starting at an average of 10.48% for school districts with less than 250 students and ending with an average of 5.59% for school districts with more than 7,500 students. Quite the opposite relationship can be seen regarding the average percentage of nonwhite students. The data shows a rapid increase as enrollment grows.

Regarding student characteristics, steady growth is seen in the relationship between the average percentage in limited English proficiency students and enrollment. For the most part, the relationship between percentage of special education students and enrollment behaves in much the same manner.

The Expenditure Model

Based on the theoretical framework established previously, and the availability of data sets concerning cost factors (here, “cost factors” refers to all of the independent variables below that are thought to have an effect on the cost of providing a given level of education), we have established the following expenditure model to investigate the presence of economies of size:

$$\ln(\text{PPE}) = \alpha_0 + \alpha_1 * \ln(\text{Enroll}) + \alpha_2 * (\ln(\text{Enroll}))^2 + \alpha_3 * \text{Proficiency} + \alpha_4 * \text{Dropout} + \alpha_5 * \text{Salary} + \alpha_6 * \text{Poverty} + \alpha_7 * \text{Nonwhite} + \alpha_8 * \text{LEP} + \alpha_9 * \text{SpecialEd} + \mu \quad (9)$$

PPE = per pupil total expenditure
Enroll = school district enrollment

Proficiency = average proficiency level
Dropout = dropout rate
Salary = teacher salary index number
Poverty = poverty rate
Nonwhite = percent nonwhite students
LEP = percent limited English proficiency students
SpecialEd = percent special education students
 μ = error term

Using the available data from 341 Iowa school districts, per pupil total expenditure was regressed against the cost-related characteristics listed above using OLS. The log-linear form is utilized regarding the enrollment size characteristic, allowing for the coefficients to reflect elasticities. In addition, the enrollment variable is squared to allow for a possible nonlinear relationship between expenditure and enrollment.

Several factors may contribute to the error term (μ) above. A regression of this nature assumes perfect technical efficiency on the part of school districts. If inputs are not utilized by school districts in a completely efficient manner, and have a systematic relationship with the independent variables used, the estimates derived by the regression will be affected (Duncombe, Miner, and Ruggiero, 1995). In addition, dealing with public goods and services raises the issue of consumers (here, students and their parents) driving both the supply and the demand for education. A more complete system using demand variables may be in order. Although the basic state aid formula for Iowa's schools may not be drastically affected by the fiscal capacity of each school district, allocative efficiency still remains an issue. A more complete system, recognizing the demands of parents for certain levels of education service and achievement, may give a better perspective on the relationship between costs and the various cost characteristics described above.

Separate analyses for per pupil instructional expenditure (PPIE), per pupil support services expenditure (PPSSE), per pupil administration expenditure (PPAME), per pupil operating and maintenance expenditure (PPOME), and per pupil transportation expenditure (PPTRPE), have also been undertaken. The form of each regression resembles that of equation (9), using the natural logarithm of each respective per pupil expenditure as the dependent variable.

Results

The coefficients and their corresponding test statistics for each expenditure model are reported in Table 3. Regarding the variables of outcome measures, the coefficients for average proficiency are positive. This fulfills the expectation that as the level of performance (the level of service) is increased, so too is the expenditure associated with the increased service. The dropout rate coefficients also bear this positive relationship with costs, as is expected. With two exceptions, however, the coefficients for average proficiency and dropout rate are not statistically different from zero.

The regression results for the teacher salary index are mixed. For per pupil total expenditure and per pupil instructional expenditure, the coefficients are positive. This matches the expectation that expenditures rise as the price of resources increase. However, this variable was negative for the other types of per pupil expenditure. A possible explanation may be that as resource prices increase, the expenditures (and in this case, the costs) of categories not directly related to instruction must decrease to make fiscal “room” for the teacher salaries. This hypothesis would seem to necessitate the use of a fiscal capacity measure, as discussed earlier. A better understanding of the differences in expenditure capability of Iowa’s school districts will lead to further explanation of the observed results. The results were also insignificant for two of the six categories of expenditure.

Regarding physical factors, we see decreasing expenditures as enrollments grow. This relationship is consistent with the presence of economies of size. Inclusion of the 29 omitted school districts in Iowa does not appear to affect this relationship, as per pupil expenditure data for these districts are consistent with the largest districts included in the

study. Economies of size are the main focus of this study, so the discussion of the enrollment regression results will be discussed at length in the next section.

The coefficients for two family background characteristics, the poverty rate and percentage of nonwhite students, were statistically different from zero for only the total and instructional per pupil expenditure models. Perhaps these characteristics only have an impact on instruction and instructional expenditures. The other types of expenditure discussed do not seem to be affected by the presence or absence of these characteristics. For the total expenditure and instructional expenditure models, both characteristics are positive. This fulfills the expectation that the presence of these factors contributes to the higher costs of providing a given level of education. Similarly, the individual student characteristics of percentage of limited English proficiency students and percentage of special education students are significant only for the total and instructional expenditures model. Surprisingly, the coefficient on percentage of LEP students is negative. This may reflect a failure to control for a relationship between the individual student characteristic, related family background characteristics, and ultimately, the fiscal capacity of the district, among other indicators of demand for education.

Due to the lack of data to include more cost factors, further investigation of the per pupil support services expenditure, per pupil operating and maintenance expenditure, and per pupil transportation expenditure models is no longer pursued in this report. In order to further the study of the relationship between cost factors and per pupil support services expenditure, one would need quality data on resource prices. Specifically, the complete data sets on salaries of support staff in Iowa school districts would greatly advance this type of investigation.

Similarly, to further study the case of operating and maintenance expenditure, data on the use and price of utilities, along with the prices of capital goods, would be needed. As noted earlier, there is currently no available data on capital amounts or expenditures for Iowa school districts. Along the same vein, data on bus and fuel expenditures would seem in order to make a more complete report on per pupil transportation costs. In general, regarding this last model, more must be known about demographic relationships between adjacent Iowa school districts. Without being able to control for the pupil density of districts (number of pupils per square mile) and sparsity of school districts (relative distance between them), one can know very little about potential cost savings from the consolidation of districts. This idea is reiterated in the conclusion of the final analyses.

Analysis

Figures 1-A through 3-B graphically present the total expenditure, instructional expenditure, and administrative expenditure models. In order to better gauge the individual effect of enrollment on each type of expenditure, the three models were graphed holding all cost characteristics at the state averages (the averages of the cross section used in this study), except those relating to the number of pupils (state averages were substituted into each variable, except those involving Enroll). Due to the small magnitudes of most coefficients in the expenditure model, inclusion of the omitted school districts in this study would not have a profound impact on the expenditure curves created here. Below is a listing of the state averages used to create Figures 1-A through 3-B. Discussion of each figure and its implications follows.

State Averages:

Proficiency = 76.2396
 Dropout = 0.7001
 Salary (Index) = 0.9970
 Poverty = 8.5287
 Nonwhite = 4.2537
 LEP = 0.9977
 SpecialEd = 0.4914

Equations for Figures 1-A through 3-B:

$$1A,1B: \text{ Total: } \ln(\text{PPE}) = -0.586 * \ln(\text{Enroll}) + 0.037 * (\ln(\text{Enroll}))^2 + 11.1001154$$

$$2A,2B: \text{ Instructional: } \ln(\text{PPIE}) = -0.683 * \ln(\text{Enroll}) + 0.043 * (\ln(\text{Enroll}))^2 + 11.0920376$$

$$3A,3B: \text{ Administrative: } \ln(\text{PPAME}) = -0.651 * \ln(\text{Enroll}) + 0.035 * (\ln(\text{Enroll}))^2 + 9.3911083$$

Figures 1-A and 1-B show the relationship between enrollment size and per pupil total expenditure, with all other cost factors held constant. Figure 1-A examines the entire range of enrollments for the 341 Iowa school districts in the study. Figure 1-B takes a closer look at the range containing the expenditure-minimizing enrollment and its estimated total expenditure. The expenditure curves featured in 1-A and 1-B show decreasing per pupil total expenditure as enrollment increases. This continues until the expenditure-minimizing enrollment is reached at approximately 2,749 students. This enrollment has a corresponding minimum expenditure of \$6,502.05 per pupil. Figures 1-A and 1-B exhibit U-shaped curves, with expenditures once again increasing after the expenditure-minimizing enrollment.

It is apparent that economies of size exist regarding per pupil total expenditure. What's more, the expenditure-minimizing enrollment level is larger than the enrollment

levels of 322 of the school districts in this study, or approximately 94.4% of the districts analyzed. This indicates that most school districts in the state of Iowa could realize some amount of cost savings by having larger enrollments. A closer look at the potential cost savings will be conducted in the next section.

Figures 2-A and 2-B graph the relationship between enrollment size and per pupil instructional expenditure, holding the other independent variables constant. Much like the graphs for per pupil total expenditure, 2-A and 2-B exhibit U-shaped curves. Per pupil instructional expenditure decreases as enrollment increases, until expenditures are minimized at the level of \$4,358.54 per pupil with an enrollment of approximately 2,813 pupils. Again, 322 of the studied school districts, or 94.4% of districts analyzed, currently have enrollments less than this number.

While similar in nature to the other figures, 3-A and 3-B carry a distinct difference with them. The relationship between enrollment size and per pupil administration expenditure is a constantly decreasing one over the domain of enrollments prevalent to Iowa school districts. Figure 3-A shows this continual decrease. Figure 3-B extends beyond the enrollment range, to properly show the U-shaped curve that is present over all enrollments. The significance of this can be seen in the expenditure-minimizing enrollment of approximately 10,938, with associated administration expenditure of \$580.54 per pupil. Every school district in Iowa lies to the left of this point on the graph. This means, if the analysis of cost-savings holds true, that every Iowa school district would have potential benefits of lower per pupil administration expenditures, simply by increasing their enrollments.

Examining cost function studies of other states' school districts since 1980 reveals many similar results to those above. Andrews, Duncombe, and Yinger (2002) compare results across the literature, noting if economies of size were found or not, and if cost-minimizing enrollment levels were present. Butler and Monk (1985) found constant returns to size for total expenditure for large districts in New York State; economies of size were found for small districts. Ratcliffe, Riddle, and Yinger (1990) discovered strong economies of size for current expenditure in Nebraska school districts. Using variable expenditure data, Callan and Santerre (1990) found economies of size for Connecticut school districts. In a 1991 study of Michigan school districts, Gyimah-Brempong and Gyapong also found economies of size for variable expenditure, up to an enrollment level of 140,000 pupils. Downes and Pogue (1994) found economies of size for operating expenditure in Arizona school districts.

Many studies from the past two decades also reveal U-shaped functions, yielding cost-minimizing enrollment levels. For New York State school districts, Duncombe, Miner, and Ruggiero (1995) discovered cost-minimizing enrollment levels for total expenditure (at 6,500 pupils), instructional expenditure (at 1,800 pupils), and transportation expenditure (at 1,200 pupils). They also found economies of size for administration expenditure. Also for New York State, Duncombe, Ruggiero, and Yinger (1996) found a cost-minimizing enrollment level of 3,700 pupils for operating expenditure. Regarding Wisconsin school districts, Reschovsky and Imazeki (1997) discovered a cost-minimizing enrollment level of 5,694 pupils for total expenditure. They also revealed a cost-minimizing enrollment level of 6,700 pupils for Texas school districts using total expenditure minus transportation expenditure (Reschovsky and Imazeki, 1999).

The variation in results across the literature and from past studies to this one may be due largely to differences evident in the states examined. Enrollment sizes may play a part in this variation, as well as unknown characteristics of districts owing to the nature of the state or region. Without further examination, one can only speculate as to why results may be similar or different from one state to the next.

Recommendations

The above analysis presents the idea that most Iowa school districts would be able to decrease expenditures by increasing their enrollments, holding all else constant, including transportation costs. Evidence presented for per pupil total expenditure, per pupil instructional expenditure, and per pupil administration expenditure points to Iowa school districts increasing enrollments and therefore pursuing some type of consolidation. This assumes, of course, that the potential benefits outweigh associated costs of consolidation, elicited below. The models above rely on the use of cross-sectional averages in data, therefore making the results applicable only on average. In other words, no specific school district should use the model results to make a decision about consolidation. If all applicable school districts were to use consolidation, on average, we would see overall potential cost-savings. Recommendations based on the presented research apply to statewide education efforts, not specific districts. The state of Iowa would be better suited to use this information to consider changes in policy that would affect the entire state (or at least the affected cross section used in this study).

Many of the gains that could be made through consolidation do not have to be realized at such large enrollment levels like 2,749, 2,813, and 10,938. The expenditure-

minimizing enrollment level for per pupil total expenditure is about 2,749. However, approximately 90% of the savings one sees when changing from an enrollment of 50 pupils to an enrollment of 2,749 pupils is actually realized by the enrollment mark of 600 (\$11,777.00 per pupil to \$7,083.90 per pupil at 600 pupils). The same situation occurs for per pupil instructional expenditure, where 90% of the savings when changing from 50 pupils to 2,813 pupils is achieved at an enrollment level of 600 (\$8,762.10 per pupil to \$4,829.60 per pupil at 600 pupils).

An enrollment level of 600 pupils results in an estimated administration expenditure of \$779.72 per pupil. This enrollment level realizes just over 80% of the savings that would occur from having the expenditure-minimizing enrollment (starting from \$1,603.60 at 50 pupils). These observations would suggest that a large-scale consolidation effort, which means combining many small districts to achieve the expenditure-minimizing enrollments, is not necessary. Movement toward an enrollment level of 600 would be sufficient to experience most of the cost benefits from consolidation. The potential pool of Iowa school districts with an enrollment less than 600 is 152 (44.57% of analyzed districts).

Based on the regression results obtained earlier, it appears that many school districts might benefit from some type of consolidation. Exactly what type of consolidation should be pursued is a matter of many cost considerations. Regarding consolidation to take advantage of instructional economies of size, school districts can either combine their student bodies (full consolidation of school districts) or whole-grade share (share responsibilities with a neighboring district on a grade-by-grade basis). Full consolidation necessitates the consideration of capital costs such as larger buildings and larger student services facilities.

In addition to increasing capital costs, both full consolidation and whole-grade sharing can only realize savings if the associated increases in transportation costs do not outweigh the benefits. More research must be conducted to measure the costs of bussing students to their new school locations. Duncombe, Miner, and Ruggiero (1995) use measures of land area and sparsity (pupils per square mile) to determine the associated costs with transporting students longer distances. With more information regarding the land area covered by each Iowa school district, and the associated sparsity data, better estimates of the true savings realized through full consolidation and whole-grade sharing will be made.

Until all of the major costs associated with full consolidation and whole-grade sharing can be more thoroughly examined, the state of Iowa should not consider recommending these types of consolidation to its small school districts based on the above results. This paper offers one side of the consolidation story, the potential benefits. The lack of data on the costs of implementing consolidation prohibits examining the full effects of such a decision in this study.

Just as the benefits of full consolidation and whole-grade sharing may not be clearly compared to the costs of transportation or capital expenditures, the benefits of administrative consolidation need to be viewed in the proper light. Combining neighboring school districts under one administrative staff would appear to create significant cost savings. This type of consolidation does not inherently bear the large transportation costs seen by the other types of consolidation. Another advantage of this type of consolidation is that while certain administrators (principals, vice-principals) could be maintained at each district site, the administration staff that oversees an entire district (superintendents, assistant superintendents) could assume the responsibilities of multiple districts. More than two

districts may lead to a loss of proper representation of individual community desires, but the combination of administration for two districts is feasible and financially beneficial.

While administrative consolidation does not bear all of the same cost considerations as full consolidation and whole-grade sharing, the benefits from the above regression must also be qualified with several other considerations. One consideration that bears mentioning is the practical reality of consolidation. Consolidation of administrative responsibilities requires the elimination of administrators and staff members, as well as facilities and equipment. In essence, money may be saved through the firing of personnel. Cost savings may not be practically reached, considering “The record on municipal consolidation reveals that these economies are seldom realized because governments are unwilling to cut staff and facilities” (Gustely, 1977). This unwillingness to eliminate positions may be a reflection of the preferences of districts that have been studied, which may have been better served by keeping the personnel. In any case, in order for fiscal benefits to be gained, difficult choices may be required of school districts.

Beyond the issues of unaccounted costs and the willingness to eliminate jobs, state school officials should also strongly consider some other factors while pursuing the option of administrative consolidation. First, each school district is experiencing its own unique situation. Each situation involves not only knowing the feasibility or practicability of consolidating with neighboring districts, but also considering the issue of allocative efficiency. Allocative efficiency may be achieved “...if households tend to sort themselves into school districts which provide a level of education close to what they demand” (Fisher 1987). The demands of households, in essence, allocate districts and their resources efficiently. Consolidation of districts, even administrative consolidation, may lead to

household demands being unfulfilled (perhaps through lack of individual representation by the administration). The demands of districts must be taken into account when consolidation is considered.

The question of enrollment size affecting student performance comes into the forefront whenever a discussion of consolidation is considered. Many small schools advocate the continuation of their smaller enrollments, with some evidence as to the reason. "All else held equal, small schools have evident advantages for achievement, at least among disadvantaged students" (Howley, 1996, p.1). Recent work by Ryan Sullivan (2004) examines the relationship between enrollment size and district performance in Iowa school districts, shedding light on this relationship and others that affect student performance. The use of administrative consolidation, while gaining the benefits of cost-saving, should not impede the ability of small schools to maintain their size, at least as far as student-to-teacher ratios are concerned. Only when full consolidation or whole-grade sharing are considered does the concern of size impeding performance become a serious issue.

Many small schools in the state of Iowa may experience cost savings from administrative consolidation. Any state school official considering this measure must first evaluate Iowa school districts to gain a measure of the average costs that will be associated with consolidation. This may help in deciding if policies promoting statewide consolidation are beneficial overall. With policies aimed at statewide benefits based on averages comes the idea that individual school districts may end up decreasing their overall costs or end up increasing them. Many hidden and unexpected costs may arise when full consolidation is considered. Without better knowledge of the impact of these costs, only the average benefits associated with the consolidation of examined school districts can be seen. It is therefore

recommended that state school officials bear the average benefits in mind when attempting to assess the average costs of consolidation. Again, the results presented are based on averages for a cross section of Iowa school districts. This information is the beginning of understanding how consolidation may ultimately impact Iowa school districts and the overall fiscal situation faced by the state.

Conclusion

The model estimated in this paper shows the presence of economies of size in examined Iowa school districts. Benefits from administrative consolidation have been shown, especially for those school districts with enrollment levels of less than 600 students. Approximately 80% of the potential cost savings can be achieved by this enrollment level (starting from a base of 50 students). School districts under an enrollment level of 600 are therefore the primary districts of concern for the use of administrative consolidation.

The use of this research in considering consolidation must be qualified. This information applies only to the average benefits (in terms of cost savings) based on a cross section of Iowa school districts, and does not consider the average costs that may be incurred should consolidation be used (such as more travel time and less administrative familiarity). The research conducted in this paper based on the developed expenditure models also has its limitations. With better measures of capital and equipment expenditures, education demand variables, land area and sparsity data, district performance, and other cost-related characteristics of school districts, work of this kind will improve for the state. Iowa may receive financial relief through consolidation, but only if such change is deemed as outweighing the cost, and only if it possesses the willingness to make the changes that might be necessary.

References

- Andrews, M., Duncombe W.D., & Yinger, J. (2002). Revisiting Economies of Size in American Education: Are We Any Closer to a Consensus? *Economics of Education Review*, 21, 245-262.
- Bradford, D., Malt, R., & Oates, W. (1969). The Rising Cost of Local Public Services: Some Evidence and Reflections. *National Tax Journal*, 22, 185-202.
- Butler, R.J., and Monk, D.H. (1985). The Cost of Public Schooling in New York State: The Role of Scale and Efficiency in 1978-79. *The Journal of Human Resources*, 20, 3-38.
- Callan, S.J., and Santerre, R.E. (1990). The Production Characteristics of Local Public Education: A Multiple Product and Input Analysis. *Southern Economic Journal*, 57, 468-480.
- Downes, T.A. and Pogue, T.F. (1994). Adjusting School Aid Formulas for the Higher Cost of Educating Disadvantaged Students. *National Tax Journal*, XLVII, 89-110.
- Duncombe, W.D., Miner, J., & Ruggiero, J. (1995). Potential Cost Savings from School District Consolidation: A Case Study of New York. *Economics of Education Review*, 14, 265-284.
- Duncombe, W.D., Ruggiero, J., and Yinger, J.M. (1996). Alternative Approaches to Measuring the Cost of Education. In H.F. Ladd, *Holding Schools Accountable: Performance-Based Reform in Education*, 327-356. Washington, D.C.: The Brookings Institution.
- Duncombe, W.D., & Yinger, J.M. (1993). An Analysis of Returns to Scale in Public Production, with an Application to Fire Protection. *Journal of Public Economics*, 52, 49-72.
- Fox, W. (1981). Reviewing Economies of Size in Education. *Journal of Education Finance*, 6, 273-296.

- Fisher, R. (1987). *State and Local Public Finance*. Glenview, IL: Scott, Foresman and Company.
- Gustely, R. (1977). The Allocational and Distributional Impacts of Government Consolidation: The Dade County Experience. *Urban Affairs Quarterly*, 12, 349-364.
- Gyimah-Brempong, K. and Gyapong, A.O. (1991). Production of Education: Are Socioeconomic Characteristics Important Factors? *Eastern Economic Journal*, XVII, 507-521.
- Hanushek, E. (1986). The Economics of Schooling: Production and Efficiency in Public Schools. *Journal of Economic Literature*, 24, 1141-1177.
- Iowa Department of Education. *Iowa Department of Education*. URL: <http://www.state.ia.us/educate/>. Date retrieved: 29 November 2004.
- Iowa Department of Education. *Iowa Department of Education School Profiles*. URL: <http://www.iowaschoolprofiles.com/>. Date retrieved: 29 November 2004.
- Iowa Department of Education. (2004). *Facts About School Funding Key Messages*. [WWW document]. URL: <http://www.state.ia.us/educate/oofd/doc/facts040809.pdf>. Date retrieved: 29 November 2004.
- Iowa Department of Education. (2004). *The State Report Card for No Child Left Behind*. [WWW document]. URL: <http://www.state.ia.us/educate/ecese/nclb/doc/reportcard04.pdf>. Date retrieved: 29 November 2004.
- Iowa Department of Education. *2002-2003 Public School District Dropouts*. [WWW document]. URL: <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04x.xls>. Date retrieved: 29 November 2004.
- Iowa Department of Education. *2003-2004 Iowa Public School District Limited English Proficient Students (LEP) by District and Grade*. [WWW document]. URL: <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04s.xls>. Date retrieved: 29 November 2004.

- Iowa Department of Education. *2003-2004 Iowa Public School PreK-12 Enrollments by District Grade, Race and Gender*. [WWW document]. URL: <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04n.xls>. Date retrieved: 29 November 2004.
- Iowa Department of Education. *2003-2004 Teacher Information by District and AEA*. [WWW document]. URL: <http://www.state.ia.us/educate/fis/pre/eddata/ied04/ied04u.xls>. Date retrieved: 29 November 2004.
- Iowa Department of Education. *Percentage of Function Categories to Total Expenditures in the General Fund*. [WWW document]. URL: <http://www.state.ia.us/educate/fis/sft/car/doc/pfctegf03.xls>. Date retrieved: 29 November 2004.
- Knudsen, J.J. (1989). *School District Consolidation in a Club Goods Framework*. Ames, Iowa: Iowa State University.
- Ratcliffe, K., Riddle, B., and Yinger, J.M. (1990). The Fiscal Condition of School Districts in Nebraska: Is Small Beautiful? *Economics of Education Review*, 9, 81-99.
- Reschovsky, A., and Imazeki, J. (1997). The Development of School Finance Formulas to Guarantee the Provision of Adequate Education to Low-Income Students. In W.J. Fowler, Jr., *Developments in School Finance*, 123-147. Washington, D.C.: U.S. Department of Education.
- Reschovsky, A., and Imazeki, J. (1999). Does the School Finance System in Texas Provide Students with an Adequate Education? Paper presented at the Annual Meeting of the American Education Finance Association, Seattle, WA, March, 1999.
- Sigel, L. (n.d.). *School Finance in Iowa*. [WWW document]. URL: <http://www.state.ia.us/tax/taxlaw/PTC-schoolaid1.pps>. Date retrieved: 29 November 2004.

Tholkes, R.J. (1991). Economies of Scale in Rural School District Reorganization.
Journal of Education Finance, 16, 497-514.

U.S. Census Bureau. *Small Area Income & Poverty Estimates*. URL:
<http://www.census.gov/hhes/www/saipe/district.html>. Date retrieved: 29 November
2004.

Acknowledgements

I would like to thank my major professor Dr. Daniel Otto, and Drs. Brent Kreider, Emily Moore, and Thomas Alsbury, along with Ryan Sullivan for all of their time and input. I would also like to thank my family for their unending support of my education.

Tables

Table 1
Factors Affecting Iowa Teacher Salaries—Regression Results

Model		Unstandardized Coefficients		T	Sig.
		B	Std. Error		
1	(Constant)	24190.385	774.829	31.220	.000
	TOTEXPR	745.918	51.187	14.572	.000
	ADVDEG	61.669	4.929	12.512	.000

a Dependent Variable: AVESAL

Adjusted State AveSal = $B_0 + B_1(\text{Average TotExp}) + B_2(\text{Average AdvDeg})$

Index # = $(\text{Reported District AveSal}) / (\text{Adjusted State AveSal})$

Average TotExp = 15.0068

Average AdvDeg = 17.8955

State AveSal = 36379.24

Adjusted State AveSal = $24190.385 + (745.918)(15.0068) + (61.669)(17.8955) =$

36487.8248319

Table 2
Cost-Related Characteristics of Iowa School Districts (Means) by Enrollment Category

ENROLLMENT								
	<250	250-399	400-599	600-999	1000-2499	2500-7499	7500+	State Ave.
Number of School Districts	29	50	73	93	75	19	2	
Number of Pupils	156	328	505	759	1503	4072	9633	990
PER PUPIL EXPENDITURE								
Total	8707.06	7379.55	6946.86	6816.63	6628.34	6653.09	6621.23	7036.15
Instructional	6367.97	5148.85	4794.58	4724.75	4644.64	4643.92	4518.49	4918.29
Support Services	334.17	367.52	378.43	422.74	499.06	550.04	564.14	422.33
Administration	1044.28	962.28	840.09	740.67	651.85	599.33	567.87	791.84
Operating & Maintenance	568.11	564.48	580.33	584.64	564.09	595.98	642.15	575.80
Transportation	359.08	320.85	336.84	325.29	255.72	224.54	248.02	308.62
OUTCOME MEASURES								
Ave. Proficiency	77.55	75.34	75.76	76.40	76.36	78.08	83.42	76.33
Dropout Rate	0.36	0.61	0.64	0.66	0.82	1.26	1.44	0.70
RESOURCE PRICES								
Teacher Salary Index	0.86	0.92	0.96	1.02	1.07	1.13	1.24	1.00
FAMILY BACKGROUND								
Poverty Rate	10.48	9.91	9.19	7.69	7.87	6.42	5.59	8.53
% Nonwhite Students	3.38	2.70	3.07	3.76	5.93	8.51	18.72	4.25
STUDENT CHARS.								
% LEP Students	0.86	0.44	0.77	1.09	1.33	1.54	3.42	1.00
% Special Education Students	0.05	0.21	0.30	0.47	0.98	0.81	0.62	0.49

Note: Seven of the 341 districts did not have available data on the poverty rate.

Table 3
Cost Factors Affecting Per Pupil Expenditures of Iowa School Districts—Regression Results

	TOTAL		INSTRUCTION		SUPPORT SERVICES		ADMINISTRATION		OPERATING & MAINTENANCE		TRANSPORTATION	
	Coeffs.	t-stats.	Coeffs.	t-stats.	Coeffs.	t-stats.	Coeffs.	t-stats.	Coeffs.	t-stats.	Coeffs.	t-stats.
Intercept	10.937	39.846	10.808	35.889	3.106	2.905	9.791	22.981	7.265	13.088	5.211	5.569
OUTCOME MEASURES												
Ave. Proficiency	0.001	0.633*	0.000	0.075*	0.012	2.978	0.000	-0.069*	0.003	1.296*	0.001	0.316*
Dropout Rate	0.006	0.803*	0.002	0.201*	0.029	0.996*	0.011	0.924*	0.037	2.457	-0.007	-0.260*
RESOURCE PRICES												
Teacher Salary Index	0.026	0.328*	0.211	2.438	-0.047	-0.152*	-0.380	-3.109	-0.438	-2.754	-0.905	-3.372
PHYSICAL FACTORS												
Pupils (natural log)	-0.586	-7.598	-0.683	-8.074	0.435	1.447*	-0.651	-5.436	-0.229	-1.471*	0.429	1.630*
Pupils Squared (natural log)	0.037	6.592	0.043	6.908	-0.020	-0.913*	0.035	4.004	0.019	1.665*	-0.035	-1.804*
FAMILY BACKGRD.												
Poverty Rate	0.004	2.445	0.005	3.319	-0.001	-0.242*	-0.003	-1.233*	-0.004	-1.270*	0.004	0.722*
% Nonwhite Students	0.005	2.742	0.007	3.614	0.011	1.590*	-0.002	-0.567*	-0.003	-0.896*	-0.011	-1.802*
STUDENT CHARS.												
% LEP Students	-0.007	-2.134	-0.010	-2.810	-0.006	-0.437*	-0.003	-0.568*	0.009	1.304*	-0.001	-0.060*
% Special Ed. Students	0.017	3.278	0.020	3.616	0.017	0.844*	0.017	2.136	-0.001	-0.122*	0.006	0.333*

* indicates insignificance at $\alpha = 5\%$

Figure 1-A: Per Pupil Total Expenditure by Enrollment Level, Iowa School Districts

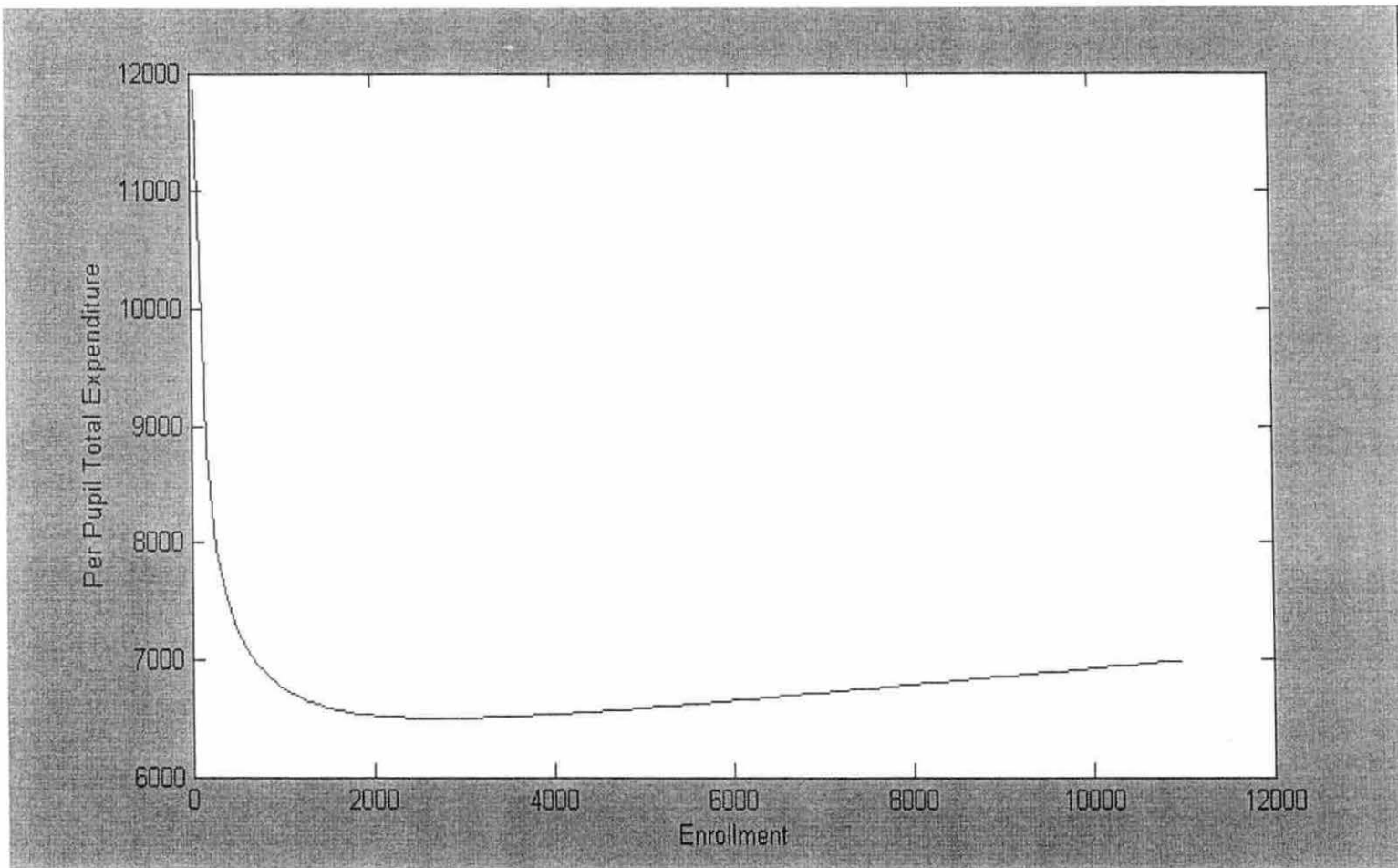


Figure 1-B: Per Pupil Total Expenditure by Enrollment Level, Iowa School Districts

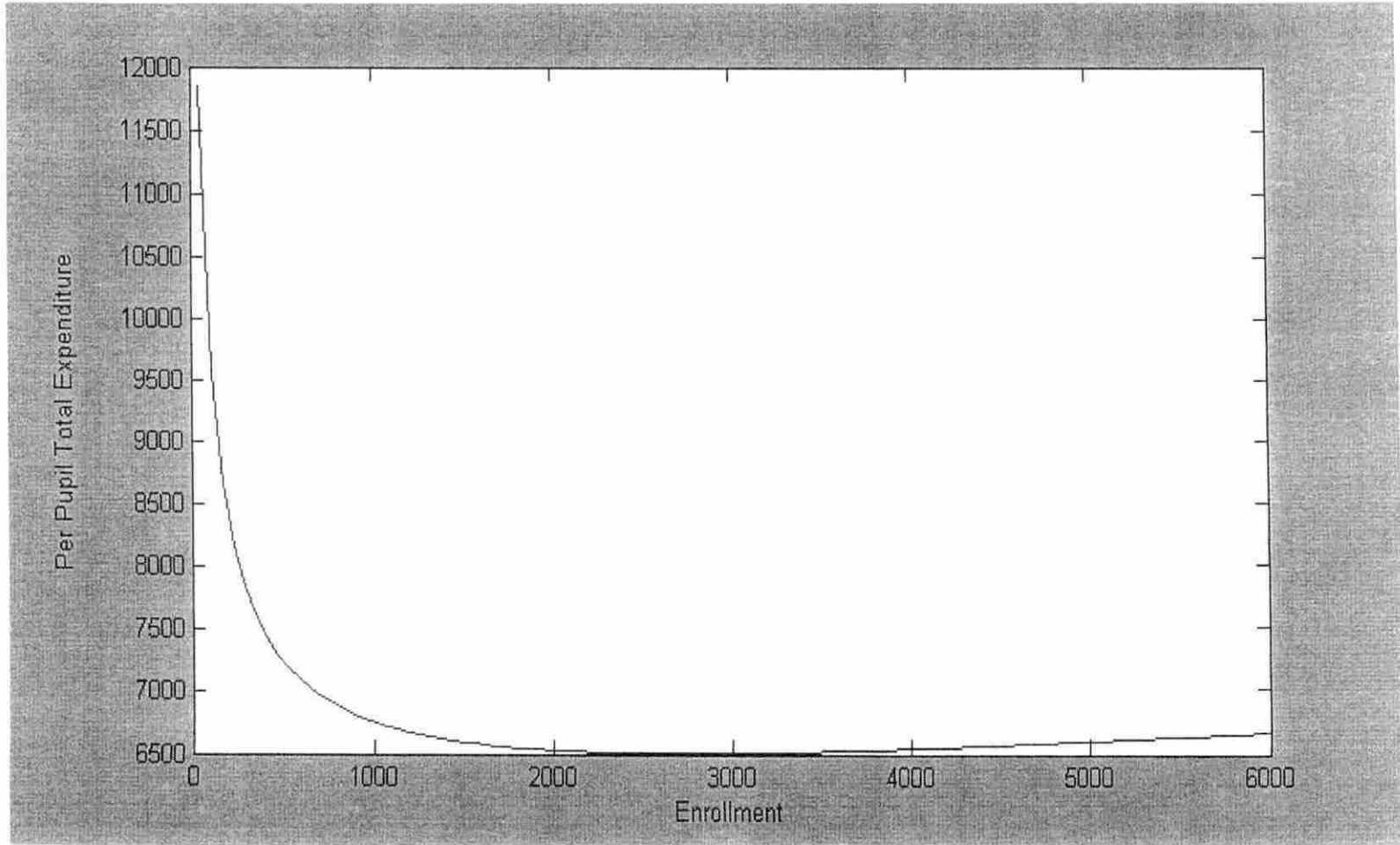


Figure 2-A: Per Pupil Instruction Expenditure by Enrollment Level, Iowa School Districts

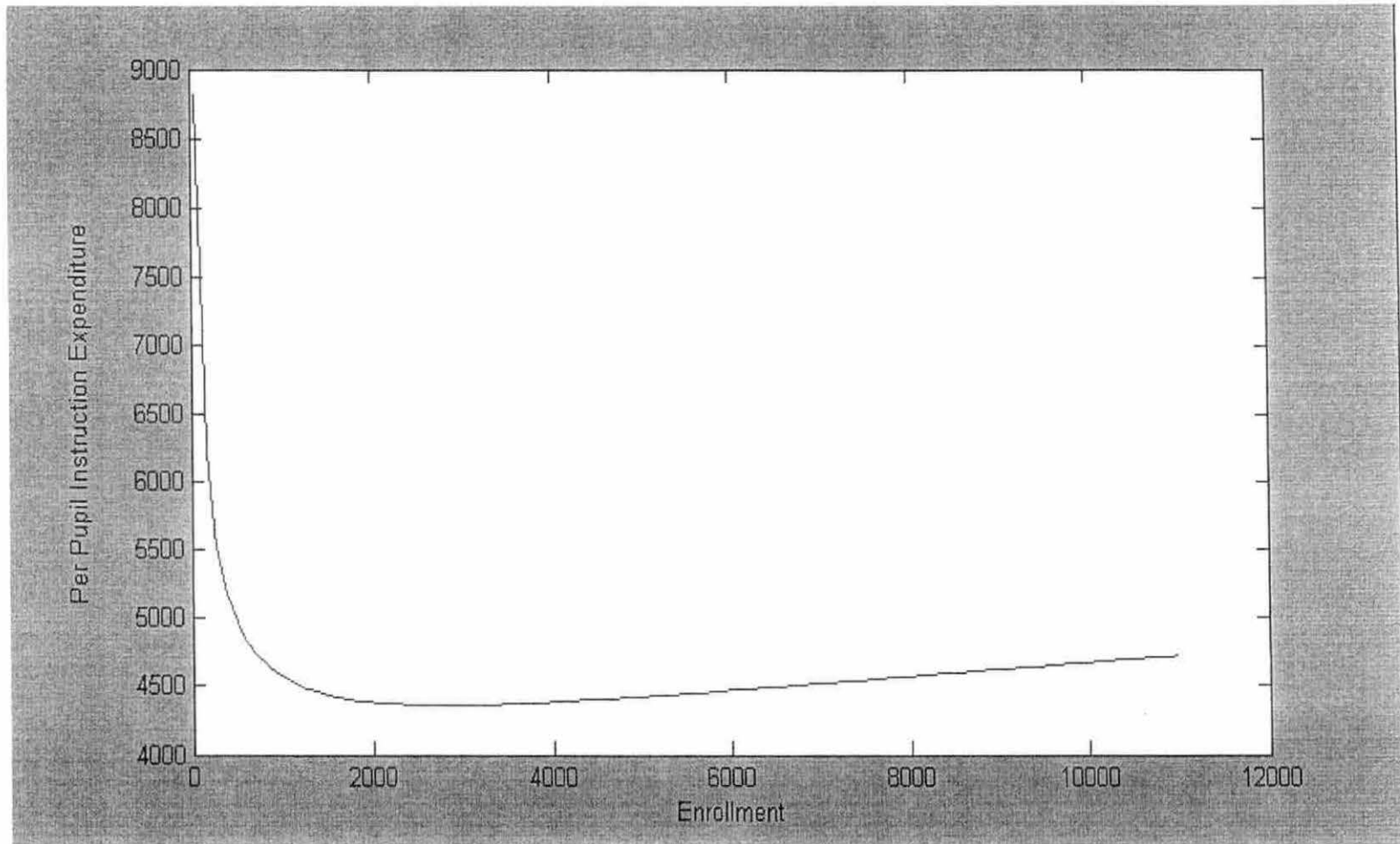


Figure 2-B: Per Pupil Instruction Expenditure by Enrollment Level, Iowa School Districts

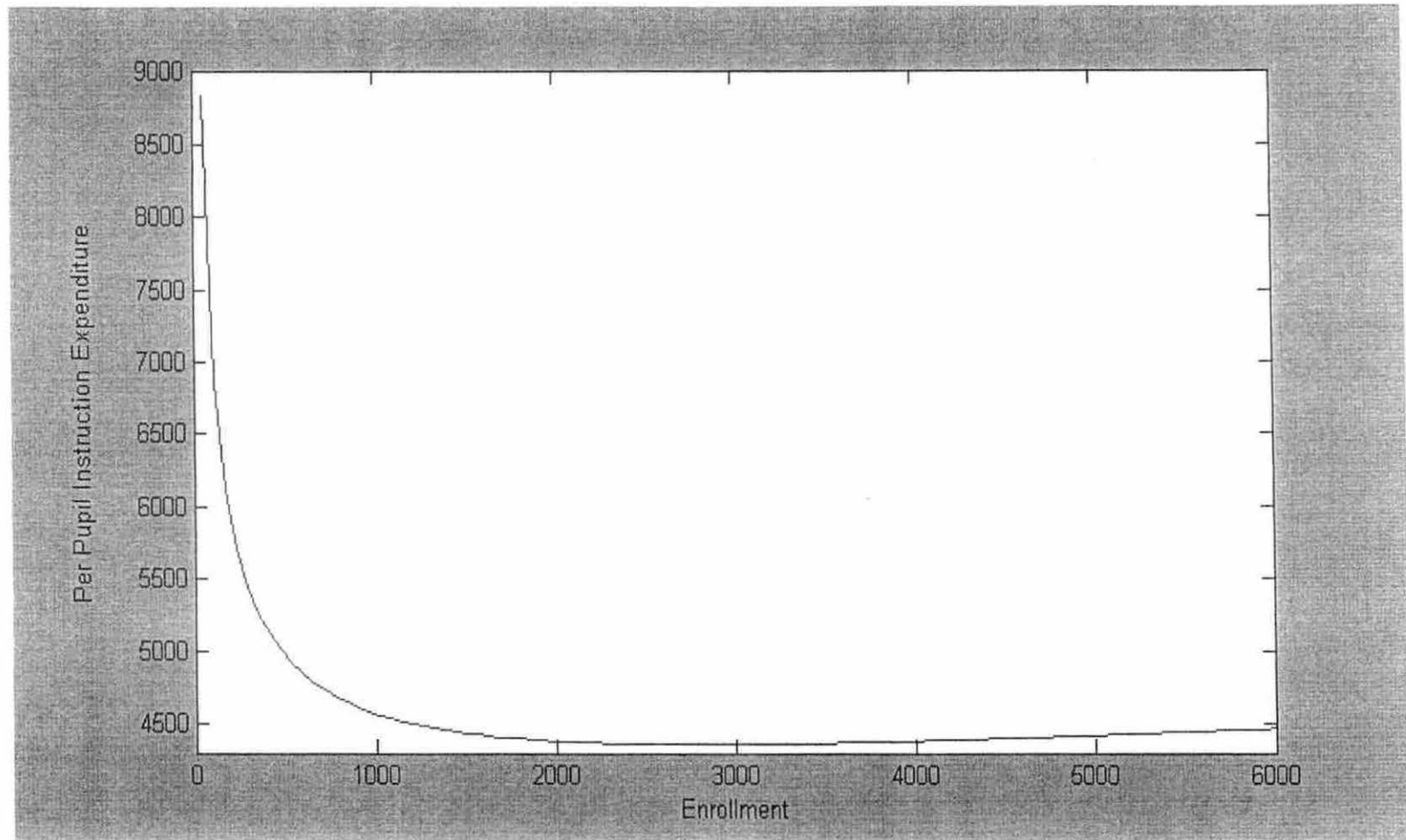


Figure 3-A: Per Pupil Administration Expenditure by Enrollment Level, Iowa School Districts

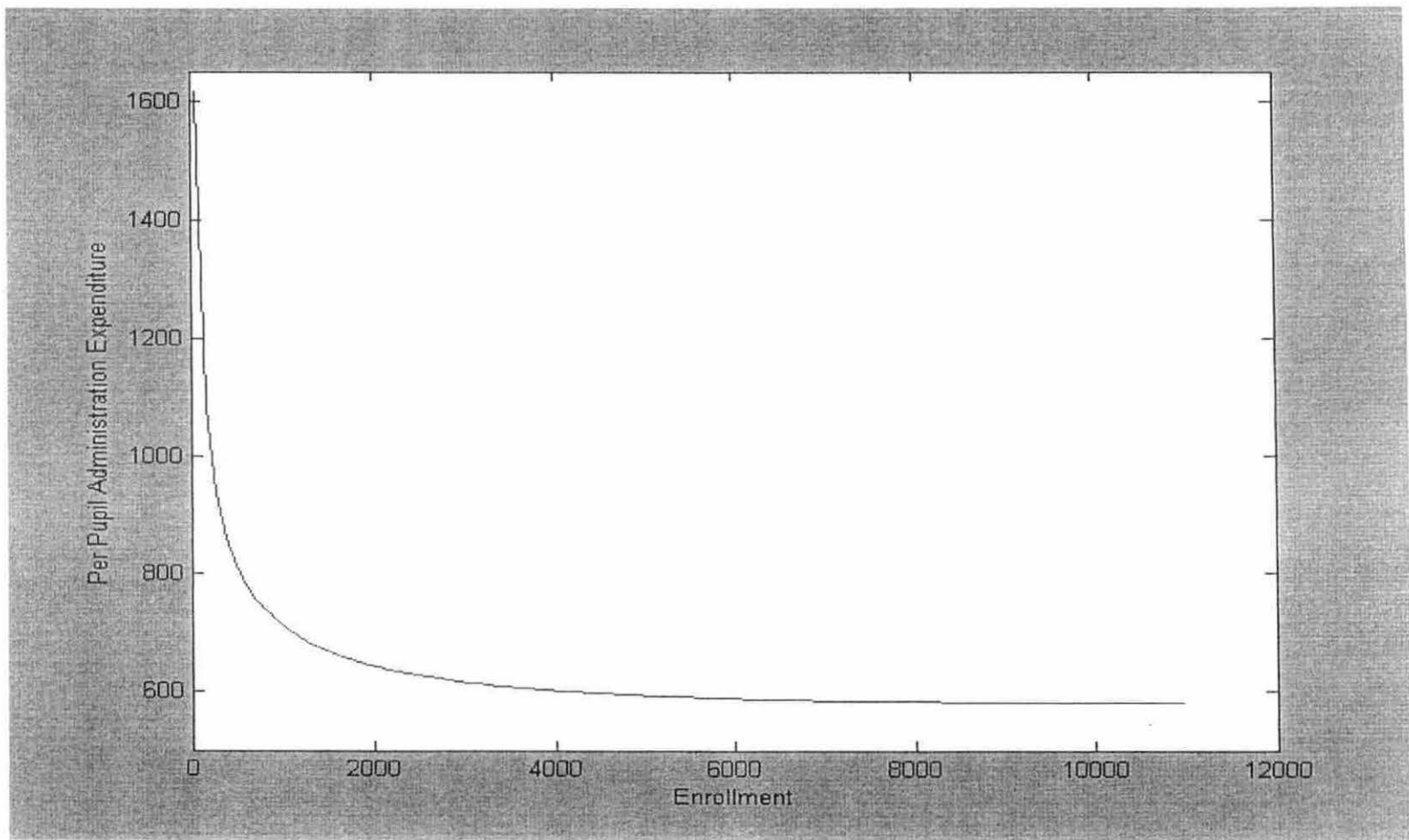


Figure 3-B: Per Pupil Administration Expenditure by Enrollment Level, Iowa School Districts

