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MAKING DIFFICULT TIMES WORSE

The Impact of Per Pupil Funding Formulas on Rural Minnesota Schools

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Seeking Solutions for Greater Minnesota's Future

Making Difficult Times Worse: The Impact of Per Pupil Funding Formulas on Rural Minnesota Schools

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Executive Summary

Sam Walton, with his chain of super stores that have become so commonplace in American society, has made his fortune largely based on the principle that "more means less." This slogan signifies more than just a good bargain at the end of an aisle, it also reflects the fact that costs can be reduced by buying and selling larger quantities of merchandise. As a result, a five-pound bag of pretzels can be purchased at the local Sam's Club for $2.99, while the local supermarket may charge $1.99 for a one- pound bag of the same pretzels.

While the tenet that cost is not directly proportional to quantity is readily accepted in the marketplace, it has yet to be applied to school finance. Instead, the logic that consistently underlies many school funding formulas assumes just the opposite. There is an unquestioned linear logic that school costs are based on a per-pupil model that is independent of the number of children enrolled in the school. In other words, most states provide a fixed amount of revenue per student, regardless of the number of children that the school district serves. But if Sam Walton is correct, and more means less, what lessons can we learn about how resources are allocated to schools? Does it really cost the same amount to educate children in small and large schools? And if it doesn't, what are the consequences of these formulas for children in smaller schools?

We examine educational expenditures for all Minnesota public schools for the 1997-98 academic year and find that the costs of educating children in smaller schools is higher per pupil than educating those children in larger schools. As a result, we recommend that a new category be introduced that supplements the existing operating

sparsity category. We propose this new category be named Small School Revenue (SSR). We develop a formula that compensates smaller schools for the higher costs that they incur due to their lower enrollments and estimate the additional costs.

Overall, the cost of the program is modest. If implemented in the manner recommended, Small School Revenue will supplement the budgets of 103 school districts with an average per pupil revenue increase of $299. Whereas the operating sparsity category costs $11 million, the new Small School Revenue will cost the state an additional $15 million. The combined operating sparsity and Small School Revenue categories will still represent just over 0.6% of total spending on education in Minnesota. Yet by providing this rather modest amount of additional revenue, the state will significantly help reduce the inequities experienced by small rural schools.

Introduction

Sam Walton, with his chain of super stores that have become so commonplace in American society, has made his fortune largely based on the principle that "more means less." This slogan signifies more than just a good bargain at the end of an aisle, it also reflects the fact that costs can be reduced by buying and selling larger quantities of merchandise. As a result, a five-pound bag of pretzels can be purchased at the local Sam's Club for $2.99, while the local supermarket may charge $1.99 for a one- pound bag of the same pretzels.

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This study examines the underlying assumption of linearity in the current educational funding formula used by the state of Minnesota. The purpose of this study is to ensure that Minnesota schools, both metro and out-state, receive adequate and equitable funding.

A Brief History of School Funding

A quick review of the educational literature shows that money matters. Sufficient school funding has been positively correlated to student achievement (Payne & Biddle, 1999; Berliner & Biddle, 1995), and it has a direct relation to teacher quality, availability of resources, and adequacy of services. Equity of school funding has been an important issue for states, particularly since the 1973 U.S. Supreme Court decision in Rodriquez v. San Antonio in which the Supreme Court ruled that access to free public education is not a fundamental right under the equal protection clause of the 14th amendment. This decision essentially placed the responsibility of equitable funding for public schools in the hands of the states, and since that time many states have faced law suits and court decisions based on their "formulas" for funding public schools (see Verstegen, 1998).

Minnesota is not alone in these efforts to provide adequate and equitable funding for its public school system. Minnesota's Constitution provides that:

> **[t]he stability of a republican form of government depending upon the intelligence of the people, it is the duty of the legislature to establish a general and uniform system of public schools (Rebell, 1998, p. 33)**

Since Van Dusartz v. Hatfield (1971), when it was determined that the wealth-based disparities in the Minnesota school financing system violated the federal equal protection clause, the state of Minnesota has funded schools by making state taxes the primary source of education. In addition, the state has attempted to reduce wealth-based disparities by increasing the foundation aid formula allowance and limiting local levy referendums (see Larson, 1990). These decisions for funding have remained largely intact, even with challenges in subsequent lawsuits, including the recent case of Skeen vs. the State of Minnesota in 1993[1].

In spite of efforts to provide for equitable and adequate education, large disparities still remain in the resources available to schools throughout the state of Minnesota, particularly for rural and small schools. This is largely attributable to the fact that educators and policymakers conceptualize funding for schools through a linear model. The general funding formula for the state of Minnesota continues to provide monies to schools based on the weighted average daily membership of the school (WADM), the number of children in attendance.

Two general principles result from this linear logic: the principle of horizontal equity, and the principle of vertical equity (see Burke, 1999). The *principle of horizontal equity* assumes that students who are equal should receive equal resources, which results in general per pupil funding allowances that remain equal for each student in the state. The *principle of vertical equity* assumes that students who are not equal should receive unequal resources. This principle is reflected in categorical funding allowances that attempt to account for these differences by providing extra funding for students with special needs, students living in poverty, or students living in remote rural areas.

As early as 1906, educator Ellwood Cubberly noted that rural schools face unique funding challenges (see Garms, Guthrie, & Pierce, 1978). Yet, no reasonable solution has been attained. The linear model of school funding has not been able to account for differences in financial need based on the size of the school and the number of students served. Howley and Eckman (1997) note:

> **The studies invariably find that more must be spent per student in small schools, especially the smallest (p. 33)**

While categorical aid to rural schools in remote areas has been considered an effort to correct the flat-rate formulas based on enrollment, these adjustments produce few hard dollars for schools that are increasingly in need of resources and facilities (see Howley & Eckman, 1997; Dayton, 1998). And as the farm crisis worsens throughout the state, rural communities will continue to face serious consequences as they struggle to provide quality educational opportunities to a declining population (see Bass, 1986). Alternative funding formulas are needed that will sustain rural schools as vital centers of communities (see Haas & Nachtigal, 1998), formulas which move away from the linear logic of the past models of school finance to more adequately provide the needed resources to these smaller schools. Before discussing an alternative model, an explanation of the current funding formula for the state of Minnesota is necessary.

How Minnesota Funds Its Public Schools

Minnesota funds its schools through various different categories of aid. Table 1 provides a brief description of each of these fund categories and the revenues provided by each. The basic revenue and general education levy makes up the overwhelming majority of state support for public schools in Minnesota. In 1999-2000, school districts received $3740 per pupil unit[2] from the basic revenue and general education levy. This total consists of both revenue from the state as well as revenue produced by a mandatory local levy. Each school district in the state is required to issue a local levy of .3658 times their adjusted net tax capacity. This amount goes to fund the local school district's basic

Table1. Funding of Minnesota Public Schools, Budget Categories, Descriptions, and Costs, 1999-2000.

Category	Description	Cost	Percent
Basic Revenue and General Education Levy	Primary funding category established by the state to establish the minimum level of funding for school districts.	$4.3 Billion	79.6%
Referendum Revenue	Revenues generated by the passage of a local referendum.	$447 Million	8.2%
Basic Skills Revenue	Provides revenue for reduced price lunches, providing services to students with limited proficiency in English, and assuring that K-8 pupils master learner outcomes in communications and math.	$254 Million	4.7%
Operating Capital Revenue	Provides revenue based on the former equipment and facilities formula.	$191 Million	3.5%
Training and Experience Revenue	Provides revenue for the school district based on the experience and education of a school district's faculty.	$80 Million	1.5%
Transportation Sparsity Revenue	Provides additional revenue for rural schools based on the number of pupil units per square mile in the school district.	$47 Million	0.9%
Equity Revenue	Provides revenue to reduce the disparity between the highest and lowest revenue districts.	$21 Million	0.4%
Transition Revenue	Provides revenue for costs that were earlier reimbursed through transportation transition and compensatory transition funds.	$14 Million	0.3%
Referendum Adjustment Revenue	Special funds available for school districts whose referendum is still reduced from the 1993 changes.	$10 Million	0.2%
Operating Sparsity Revenue	Provides revenue for small and isolated schools.	$11 Million	0.2%
Supplemental Revenue	Originally a grandfather revenue, but since has been adjusted for changes in training and experience revenue.	$8 Million	0.1%
Shared-Time Aid	Revenues to compensate school districts when nonpublic school students attend their school for part of the day.	NA	NA
Total		**5.4 Billion**	**100%**

Source: Financing Education in Minnesota, 1999-2000: A Publication of the Minnesota House of Representatives Fiscal Analysis Department. August 1999.

revenue and general education levy. The basic revenue and general education revenue is equalized, meaning that the state will contribute the difference in the amount of local revenue produced by the levy and the $3740 per pupil unit guaranteed to school districts for basic revenue.

Referendum revenue makes up the next largest category of school district financing. The state of Minnesota allows school districts, after approval of a local referendum, to levy up to an additional $350 per pupil unit with equalization[3]. Amounts levied above $350 per pupil unit must be raised entirely by the levy and are capped at $860 per pupil unit[4].

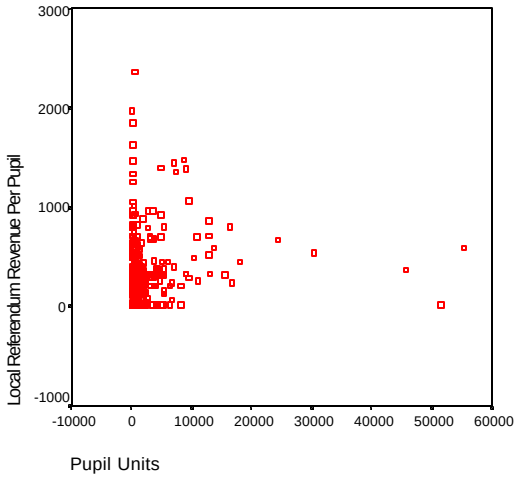
While there are several additional categories of aid, they cumulatively amount to a small portion of a district's total budget. The remaining ten budget categories collectively amount to less than fifteen percent of the total budget for local school districts. Most of the remaining funds reimburse school districts directly for expenditures such as transportation, school lunches, and English proficiency programs.

Is The System Equitable?

The fundamental purpose of this paper is to examine the assumption that the basic revenue formula adopted by the state of Minnesota equitably finances the state's public school districts. The state formula assumes that regardless of a school district's enrollment, the revenue per pupil that is needed to provide for basic education will be constant regardless of the size of a district's enrollment. Figure 1 graphically describes this assumption. Regardless of the number of students enrolled, according to the state formula, it should cost the same amount per pupil to educate children.

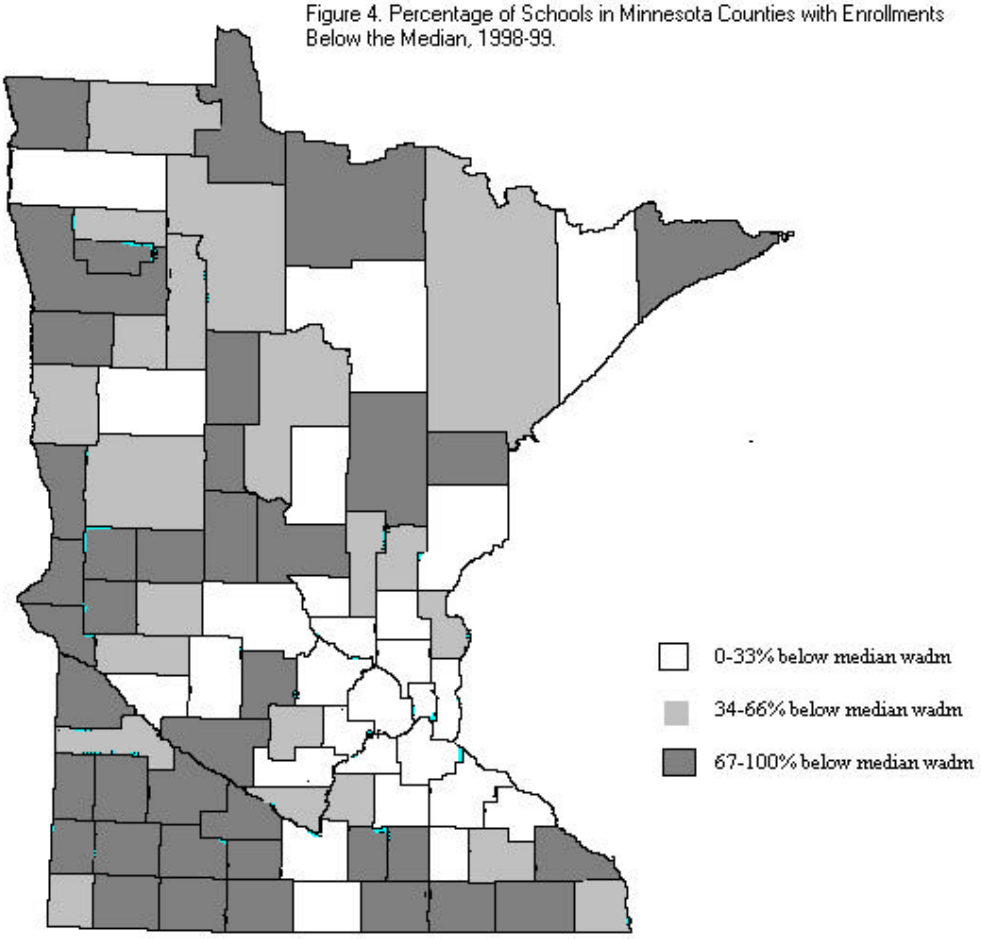
How do small school districts make up for this funding inequity? Figure 3 shows that low enrollment schools are much more likely to use local referendums to produce the revenue necessary to educate their students. Faced with higher costs per pupil of educating their students, districts with lower enrollments have no other choice but to supplement the state's contribution with local revenue.

Figure 3. Local Referendum Revenue Per Pupil, 1997-1998.



Up until now, our discussion has focused on the size of the school and the effects that the current funding formula has on small schools. Yet the size of schools is highly correlated with location as well. Figure 4 shows that most of these lower enrollment schools are found in rural Minnesota.

Figure 4. Percentage of Schools in Minnesota Counties with Enrollments Below the Median, 1998-99.



Many of these counties with smaller schools are primarily agricultural. The inequity resulting from the per-pupil funding formula undoubtedly contributes to the hardship that is already prevalent in these regions of Minnesota. Most of these agricultural counties have been in financial distress since the early 1980's, and many demographers forecast continued hardship for these regions (for a summary, see Faces of the Future: Minnesota County Population Projections, 1995-2025). Any inequity in the school funding formula that result in a disproportionate burden on these agricultural areas is particularly troublesome.

A More Accurate Estimate of the Costs of Educating Minnesota Students

If the costs of educating children in Minnesota are not fixed, what are the actual costs? We have developed a model that appears to accurately reflect the costs of educating students in Minnesota schools. Although linear models of funding, such as the per pupil funding formula used by the state of Minnesota, are convenient and easy to understand, they do not adequately account for the fact that the cost of educating a child is in part, a function of the enrollment of the school. We hypothesize that the functional form of the relationship can best be summarized by the following inverse log function:

Equation 1. **Expenditures Per Student =** $\frac{b}{\log_{10}(x)}$

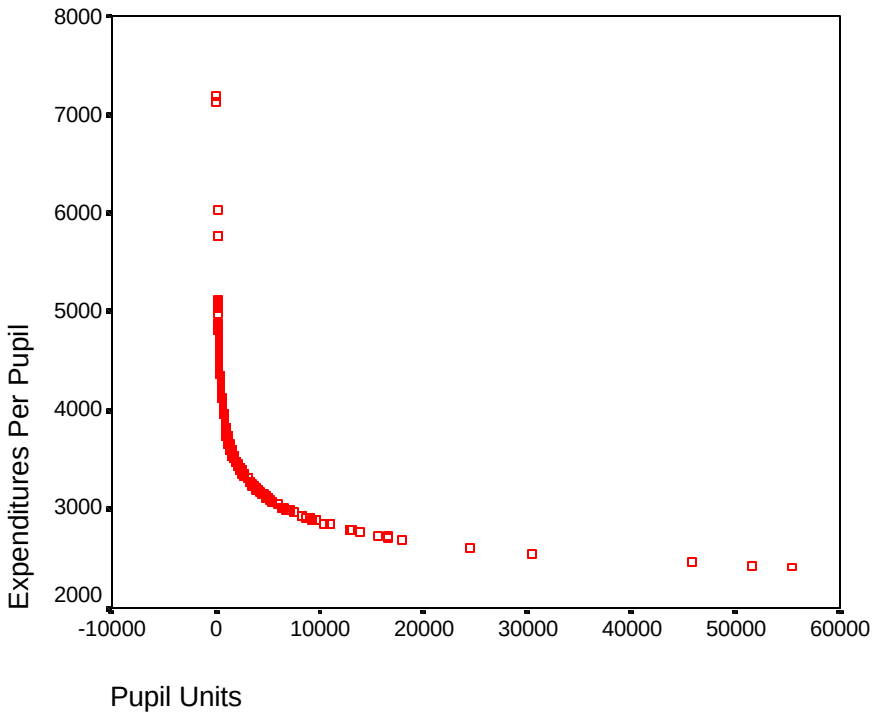
where: x = pupil units in the school district

Rather than assuming that the cost of educating children is constant regardless of enrollment, our model explicitly projects the different costs of educating children based on the school's enrollment. We tested this equation using current funding data provided by the Department of Children, Families, and Learning for the 1997-98 academic year[6].

The interpretation of logarithms is straightforward. Logarithms are easy to interpret if you understand that the log of any number = 10^x. For example the log of 10 = 1, the log of 100 = 2, the log of 1000 = 3, and the log of 10,000 = 4, etc. Thus this model, unlike the linear model in Figure 1, predicts a much different relationship between enrollment and total expenditures per pupil. Rather than predicting a flat relationship between expenditures per pupil and enrollment, the model predicts a more dynamic relationship. Figure 5 depicts this relationship in more detail. If the logarithmic

relationship is verified by the data, schools with lower enrollments will incur higher costs per student than schools with higher enrollments. How well does Equation 1 and Figure 5 fit the data?

Figure 5. Predicted Expenditures[7] Per Pupil Using The Model Described in Equation 1, 1997-98.



We submitted Equation 1 to empirical analysis using the school district revenue data from 1997-98. The model does a very good job predicting school district expenditures with schools of varying enrollments. A common empirical test used to measure model fit is R^2. The value of R^2 falls between 0 and 1, with 0 indicating that the model does not explain much of the variance, and hence is not very valuable. An R^2 of 1 indicates that the model perfectly predicts the value of the dependent variable, indicating very good model fit. Model fit for Equation 1 was excellent. The R^2 of the model is .97, indicating that the model can explain 97% of the variance in expenditures per pupil.

The full estimation of the model is:

Educational Expenditures Per Pupil = $\frac{11{,}870}{\log_{10}(x)}$

To illustrate the size of the effect, it is common to use multiple values of the independent variable to demonstrate the size of the effect on the dependent variable. For example, the model suggests that for a school district with enrollment of 1000 students actual expenditures will average $\frac{11{,}870}{\log_{10}(1000)}$, or $\frac{11{,}870}{3}$, or $3,957 per student. In contrast, a school district with an enrollment of 2,000 students will have average costs of $\frac{11{,}870}{\log_{10}(2{,}000)}$, or $\frac{11{,}870}{3.3}$, or $3,597 per student. Clearly the enrollment of the school has a substantial effect on the amount of revenue required to educate students in districts with varying enrollments.

Policy Implications

The state's per pupil funding assumption that it costs the same amount of money to educate a child in a school regardless of its enrollment is clearly flawed. This system has resulted in predominantly rural schools with typically lower enrollments paying higher amounts of their per pupil expenditures through local referendum revenues. What can be done to correct this inequity?

The operating sparsity category provides some revenue to very small schools in very isolated areas. Unfortunately, to qualify for sparsity revenue at the elementary school level, a district must be at least 19 miles from the next nearest elementary school. In addition, class sizes must not average more than 20 pupils per grade level. Because of

these substantial restrictions, only about 70 of the state's 353 school districts qualify for sparsity aid.

Another budget category that is intended to provide relief to smaller, less wealthy schools is the equity revenue category. A district's equity revenue is determined by first ranking school districts by totaling their basic, transition, supplemental, and referendum revenues. All school districts below the 90th percentile in this ranking qualify for equity revenue. The amounts, however, are very small. Districts without referendum revenue are eligible for up to $22 per pupil, while district with referendum revenue are eligible for up to $40 per pupil. Equity revenue thus does little to alleviate the inequity between wealthier and poorer, or larger and smaller, school districts.

We recommend that a new category be introduced that supplements the existing operating sparsity category. We propose this new category be named Small School Revenue (SSR). Small School Revenue would be allocated to small K-12[8] schools in the following manner:

$$\textbf{Small School Revenue} = \frac{11{,}870}{\log_{10}(weightedADM)} \textbf{ - Average BSTR – Sparsity}$$

where:

Average BSTR = the sum of the average amount of basic, supplemental, transition, and referendum revenues. For 1997-1998, this total was $4003.

Sparsity = the amount of operating sparsity revenue received by the school district during the current academic year.

Under this recommendation, the location of a school would not be a factor that determines eligibility for Small School Revenue. Recent research suggests that

encouraging the consolidation of school districts may not be educationally sound policy (Walberg and Fowler 1987; Goodlad 1984).

The formula for Small School Revenue is based on the difference in the likely costs incurred by the school district, as represented by $\frac{11{,}870}{\log_{10}(weightedADM)}$, minus the median aid in basic, supplemental, transition, and referendum revenues. Finally, those schools that currently receive sparsity aid will have that amount subtracted from the Small School Revenue category. The resulting amount represents the shortfall that a small school district will experience based on its current enrollment. When yearly adjustments are made to the basic formula, the same coefficient should be used to increase Small School Revenue as well.

If implemented in this manner, Small School Revenue will supplement the budgets of 103 K-12 school districts with an average per pupil revenue increase of $299. Whereas the operating sparsity category costs $11 million, the new Small School Revenue will cost the state an additional $15 million. The combined operating sparsity and Small School Revenue categories will still represent just over 0.6% of total spending on education in Minnesota. Yet by providing this rather modest amount of additional revenue, the state will significantly help reduce the inequities experienced by small rural schools.

More Equitable Funding or Encourage Consolidation?

Some might argue that because it costs more to educate children in smaller schools, we should simply encourage consolidation in order to become more cost efficient. This approach, however, would clearly result in state government incurring

much higher costs over the long term. When schools close, their communities close with them. For communities without schools, it becomes nearly impossible to attract young families to the area. As a result, there tends to be a general migration out of those communities. Businesses in the area will have difficulty surviving. Home prices will drop. As businesses close, it will become more difficult for communities to sustain themselves.

How does this affect the state? The intense economic hardship of rural communities will surely manifest itself in extraordinarily high costs to the state in the form of decreased income and property tax revenue. In addition, those areas that experience migration into their communities may well experience population density problems, such as higher crime rates, traffic congestion, and over-crowded schools.

Minnesota has recently appropriated significant revenue to reduce class size. Inherent in that philosophy is a belief that small classes, where teachers have time to individually interact with students, are more conducive to learning and student achievement than larger classrooms. Does it therefore make sense to encourage the formation of large schools through consolidation? Perhaps the state has realized that although smaller classes and smaller schools are slightly more expensive, they are well worth it.

Conclusion

The current formula for funding schools produces inequities that are detrimental to small rural schools. The same rural communities that are suffering economically are being asked to pay a disproportionately high share of their educational expenses. Only

by altering the fixed per pupil funding system in Minnesota will small rural schools receive an equitable share of education spending.

In this paper, we have demonstrated that the basic per pupil model of funding education in Minnesota is inequitable to students in small schools. We demonstrate that a more accurate accounting of costs does not assume a fixed cost of educating each student. Rather, educational costs are in part, a function of school size. We present empirical evidence to demonstrate that a more precise relationship between enrollment and expenditures is actually log-linear, rather than linear. We propose an adjustment to the state formula that corrects for this inherent weakness of the existing system of funding education in Minnesota.

Notes

[1] Skeen vs. the State of Minnesota (1993) held that the state's system of funding public schools was not a violation of the state constitution's education article, nor was it a violation of the equal protection provisions (see Dayton, 1998).

[2] Because the cost of educating children varies with their grade level, the state formula adjusts student enrollment so that kindergarten students are counted as .557 pupil units, elementary school students in grades one through three are counted as 1.115 pupil units, elementary school students in grades four through six are counted as 1.06 pupil units, and secondary students in grades seven through twelve are counted as 1.3 pupil units.

[3] A school initially establishes its total referendum revenue. This amount is then multiplied by the property market value divided by the equalization factor of $476,000. This amount will be the amount contributed by the local school district through its referendum revenue. The state will equalize that amount up to the total referendum revenue.

[4] School districts may levy higher limits only if their district's referendum already exceeds that amount or if the district qualifies for sparsity aid.

[5] A close examination of Figure 2 shows that the data points for the largest school districts, Minneapolis and St. Paul, actually show increases in the amount per pupil that it costs to educate students. This trend may indicate the need for adding an additional variable for urban areas.

[6] Only school districts that offered full K-12 services were included in this analysis.

[7] For the regression analysis, the costs used as the dependent variable were the sum of the basic revenue, supplemental revenue, transition revenue, and referendum revenue.

[8] Our proposal only includes funding for small K-12 schools. If the state should choose to make small school funding available for schools that only serve a portion of these students (i.e. K-6, etc.), the state could project the school's enrollment if it offered full K-12 programming and offer a proportion of the aid accordingly.

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Appendix A. Proposed Small School Revenue for K-12 School Districts in Minnesota (Estimates Using 1997-98 Data)

DISTRICT NUMBER	DISTRICT NAME	SMALL SCHOOL REVENUE PER WADM
2.00	HILL CITY	370.61
4.00	MCGREGOR	31.17
21.00	AUDUBON	472.80
24.00	LAKE PARK	227.27
36.00	KELLIHER	618.16
55.00	CLINTON-GRAC	163.03
62.00	ORTONVILLE	46.14
75.00	ST. CLAIR	67.18
81.00	COMFREY	854.74
95.00	CROMWELL	558.43
100.00	WRENSHALL	433.43
118.00	REMER	39.04
173.00	MOUNTAIN	43.47
175.00	WESTBROOK	628.73
195.00	RANDOLPH	274.61
207.00	BRANDON	396.65
208.00	EVANSVILLE	468.73
213.00	OSAKIS	39.92
229.00	LANESBORO	441.08
238.00	MABEL-CANTON	271.78
242.00	ALDEN	443.01
245.00	GLENVILLE	429.64
253.00	GOODHUE	100.08
261.00	ASHBY	570.39
264.00	HERMAN-NORCROSS	733.15
294.00	HOUSTON	125.77
297.00	SPRING GROVE	232.47
306.00	LAPORTE	572.81
308.00	NEVIS	363.86
330.00	HERON	389.59
356.00	LANCASTER	874.15
362.00	LITTLEFORK	405.62
363.00	SOUTH KOOCHI	565.58
391.00	CLEVELAND	188.71
404.00	LAKE BENTON	634.08
409.00	TYLER	342.52
411.00	BALATON	678.71
414.00	MINNEOTA	121.57
421.00	BROWNTON	355.55
424.00	LESTER	157.37
435.00	WAUBUN	39.04

441.00	NEWFOLDEN	332.95
447.00	GRYGLA	772.27
458.00	TRUMAN	167.60
473.00	ISLE	144.05
486.00	SWANVILLE	331.37
487.00	UPSALA	266.18
495.00	GRAND	277.45
497.00	LYLE	542.10
499.00	LEROY	248.37
500.00	SOUTHLAND	17.50
505.00	FULDA	54.27
507.00	NICOLLET	311.26
511.00	ADRIAN	75.67
514.00	ELLSWORTH	775.64
542.00	BATTLE	58.84
545.00	HENNING	187.51
547.00	PARKERS	42.58
550.00	UNDERWOOD	308.23
561.00	GOODRIDGE	824.84
577.00	WILLOW	137.52
581.00	EDGERTON	702.31
592.00	CLIMAX	1064.17
599.00	FERTILE-BELTRAMI	160.76
600.00	FISHER	824.84
627.00	OKLEE	667.24
628.00	PLUMMER	967.03
630.00	RED LAKE FALLS	171.06
640.00	WABASSO	165.31
654.00	RENVILLE	197.17
671.00	HILLS-BEAVER	296.29
676.00	BADGER	711.40
698.00	FLOODWOOD	427.75
763.00	MEDFORD	130.01
768.00	HANCOCK	506.40
771.00	CHOKIO-ALBERTA	472.80
775.00	KERKHOVEN	25.14
786.00	BERTHA-HEWITT	120.53
787.00	BROWERVILLE	181.58
803.00	WHEATON	164.17
806.00	ELGIN	68.12
818.00	VERNDALE	339.31
820.00	SEBEKA	61.60
836.00	BUTTERFIELD	711.40
850.00	ROTHSAY	699.31
852.00	CAMPBELL	755.67
914.00	ULEN	386.09

2159.00	BUFFALO	21.73
2167.00	LAKEVIEW	96.09
2171.00	KITTSON	113.27
2215.00	NORMAN	147.35
2311.00	CLEARBROOK	81.42
2358.00	KARLSTAD	290.42
2527.00	HALSTAD	379.15
2536.00	GRANADA	271.78
2609.00	WIN-E-MAC	166.45
2683.00	GREENBUSH	79.50
2754.00	CEDAR	183.94
2759.00	EAGLE	45.25
2854.00	ADA-BORUP	93.12
2856.00	ARGYLE	124.72