



Bureau of Legislative Research
Policy Analysis & Research Section



Equity of Revenues and Expenditures in Arkansas School Districts



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2016 Adequacy

Historical Context

Equity is a key component of achieving and maintaining a constitutionally sound system of funding education in Arkansas, and has been since the 1983 case *Dupree v. Alma Sch. Dist. No. 30*. The *Lake View* cases reaffirmed this principle.

The Adequacy Study statute, Ark. Code Ann. §10-3-2102, requires the Education Committees to "review and continue to evaluate the method of providing equality of educational opportunity of the State of Arkansas and recommend any necessary changes."

This report provides information on the state's educational equity, using standard statistical measures accepted by the Court.

Three approaches have been established to measure equity:

1) "Horizontal equity" analyses examine the degree to which districts receive equal funding, 2) "fiscal neutrality" examines the relationship between property wealth and funding, and 3) "vertical equity" measures equity of spending according to district characteristics.

Horizontal Equity Statistics

I will discuss these 3 approaches and the respective acceptability standards and findings in the BLR Adequacy Study for 2013-15.

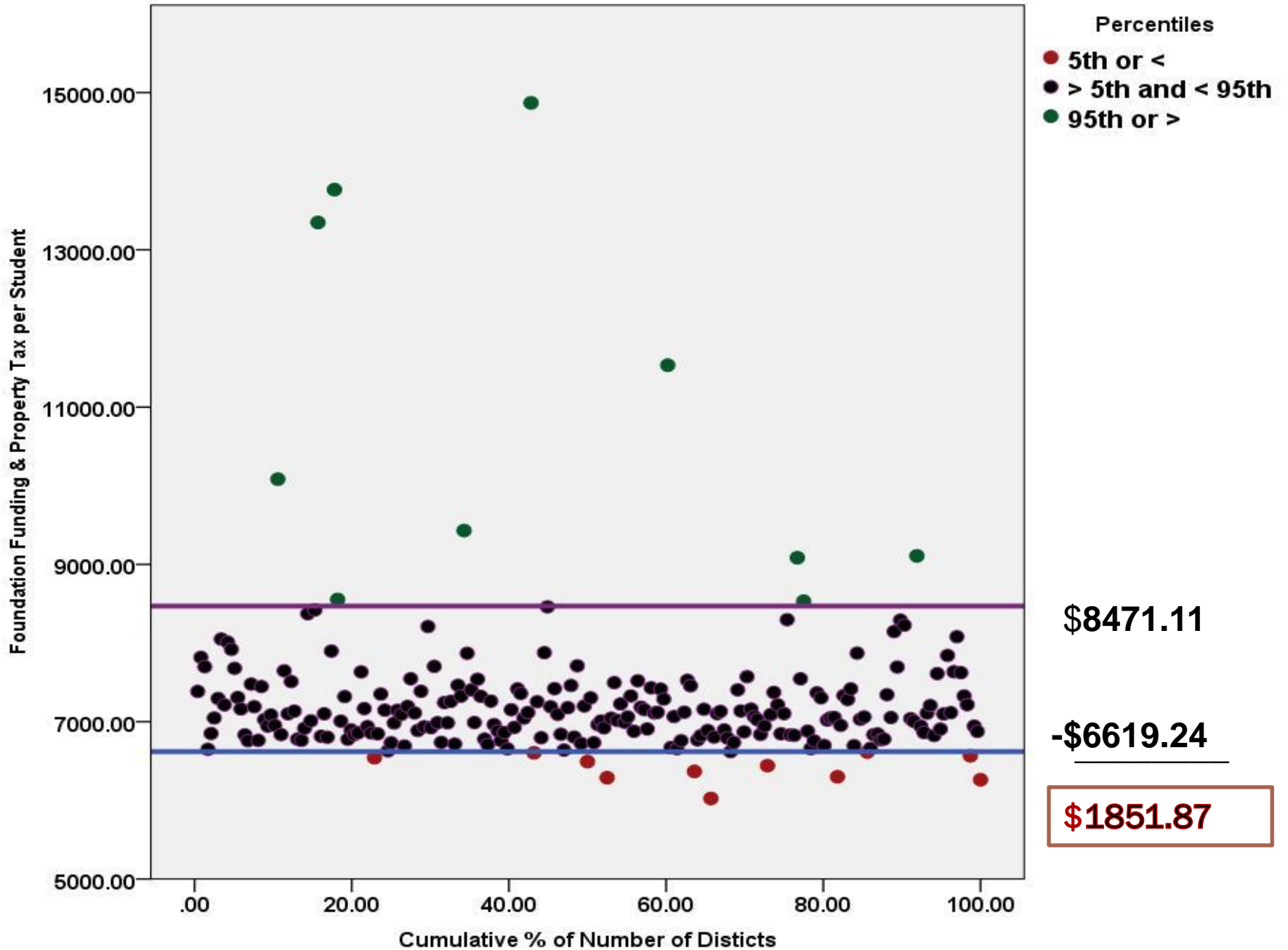
There are 6 statistics commonly used to measure horizontal equity. The statistics that examine extremities (or lowest and highest dollar amounts) of the distribution of revenues across the state is the restricted range and federal range ratio.

The restricted range is simply the difference between per pupil revenue at the 5th and the 95th percentiles. This restriction eliminates “outliers,” or the few extremes that are not representative of the other districts.

It is a limited measure because it only considers the difference between two values (5th and 95th %iles), and it is influenced by extraneous factors such the economy and state characteristics.

Because the restricted range is heavily influenced by extraneous factors, acceptability of ranges is determined by professional judgment of decision-makers. Restricted range for 2015 shown on next slide.

Example of Restricted Range



Horizontal Equity Statistics

The federal range ratio divides the restricted range by the value at the 5th percentile. This eliminates problems with extraneous factors, but still leaves the limitation of examining only the two extreme revenue values. In 2015, the ratios are 0.28 for foundation + taxes, and 0.33 for foundation + other adequacy funding in the BLR study.

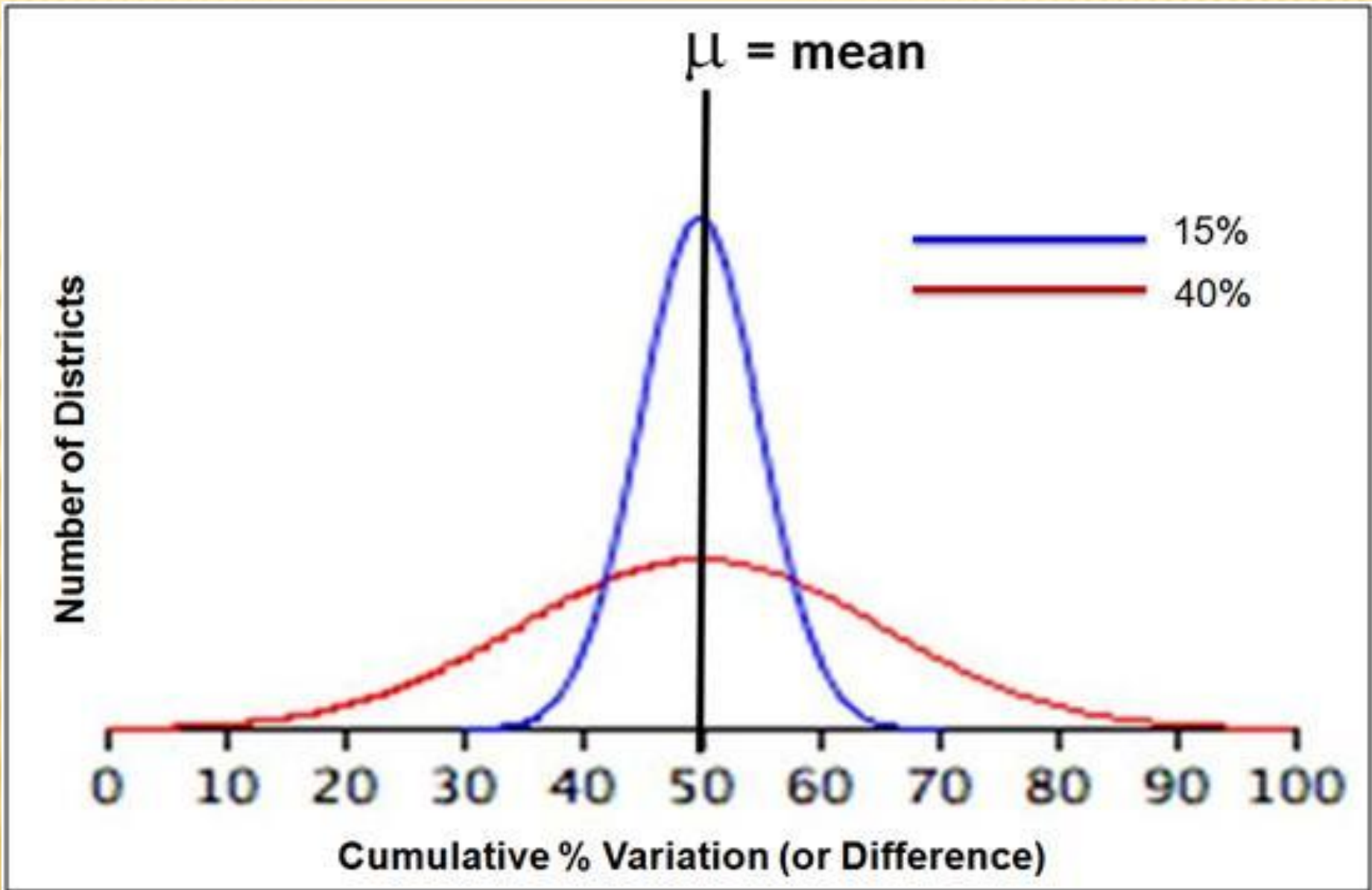
Acceptability standards range from 0.25 to 0.40 in literature.

A very common statistic that examines the differences in revenue among all districts is the standard deviation, which is the square root of the sum (Σ) of squared differences between districts' revenues and the mean (μ) divided by the number (N) of districts.

$$SD = \sqrt{\Sigma (x - \mu)^2 / N}$$

When you divide the standard deviation by the mean, you have the coefficient of variation, which can be expressed as a decimal or %. It is the percentage of variation on both sides of the mean (or average). The 0.17 and 0.16 are in the acceptable ranges noted.

Chart 1. Example of Coefficient of Variation



Horizontal Equity Statistics

The Gini coefficient (GC) also examines differences in revenue between all districts, and it, too, is unaffected by extraneous factors. It is one of the most powerful equity measures, but also the most complicated.

To determine the GC, a graph is created by plotting the cumulative percentages of the total revenue for districts on the vertical axis and the cumulative percentages of the number of districts on the horizontal axis.

The resulting graph indicates the degree to which revenue is distributed equally to districts at various percentiles.

If the revenue distribution is perfectly equitable, the graph would be a straight 45 degree line. With perfect equity, 20% of the districts would receive 20% of the funding, 40% would receive 40%, and so on.

If the distribution is less than perfect, the graph will be a concave Lorenz (or Gini) curve (seen on the next slide).

Chart 2. Example of Lorenz (or Gini) Curve

$$\text{Gini} = \frac{A}{A + B}$$

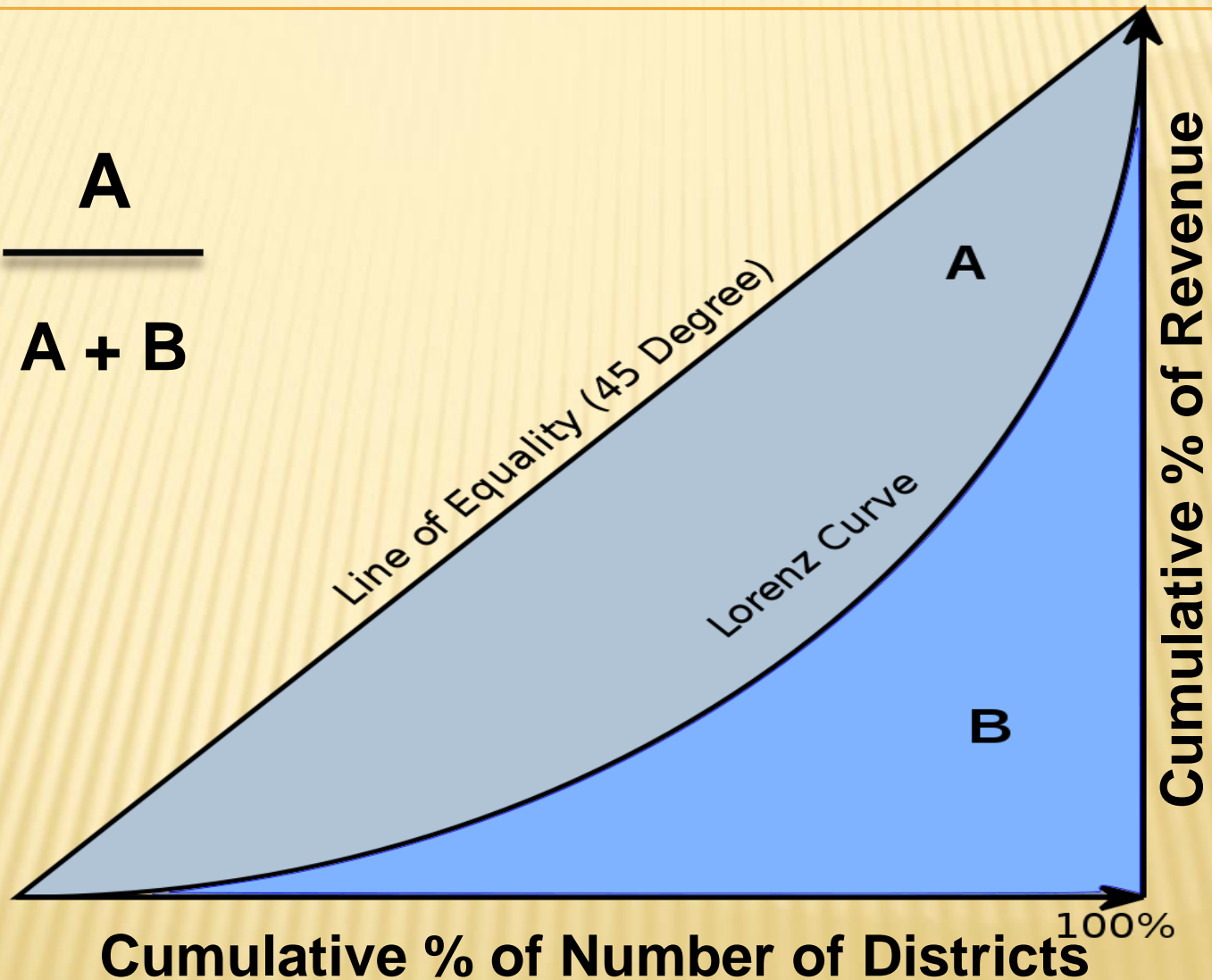
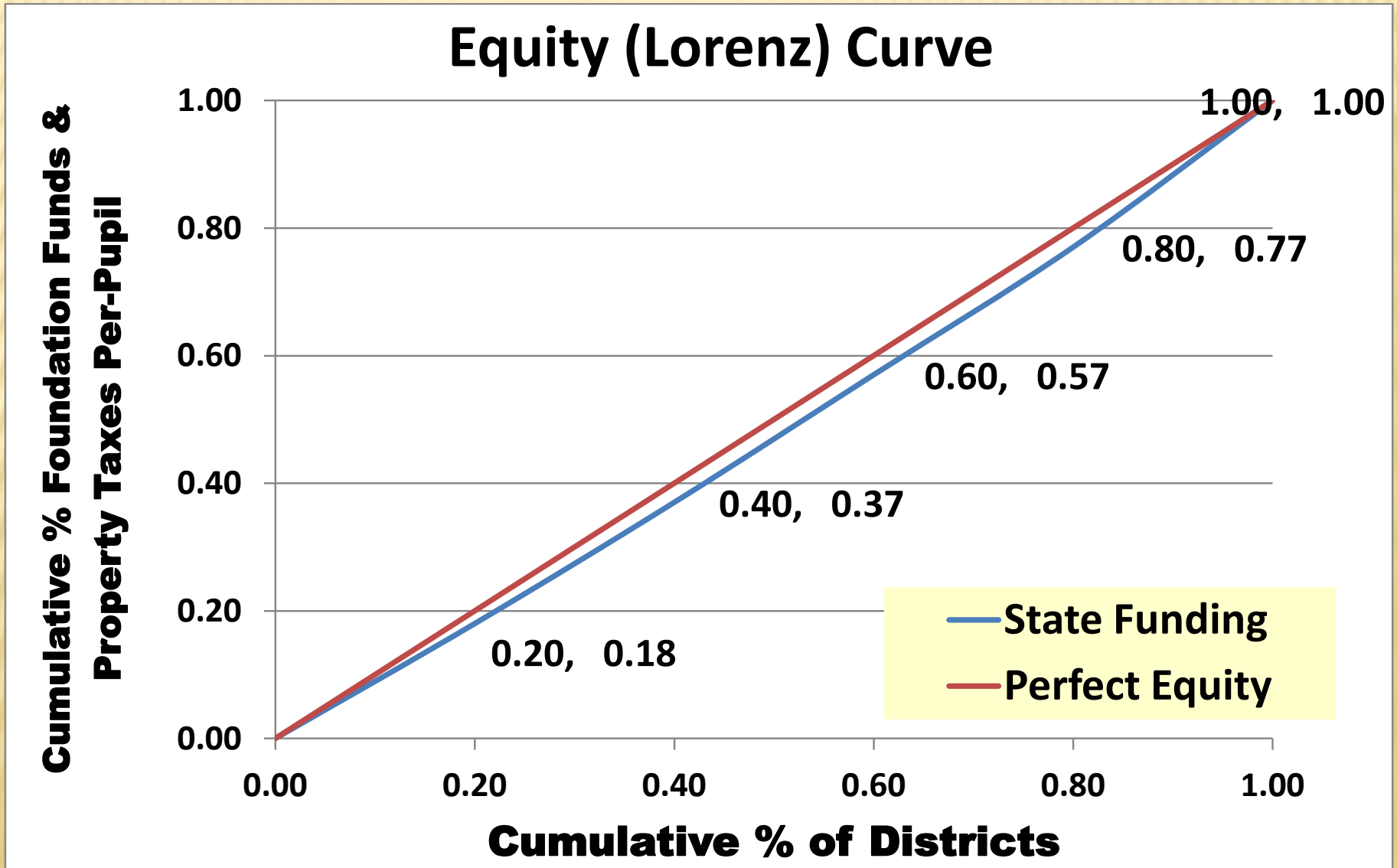
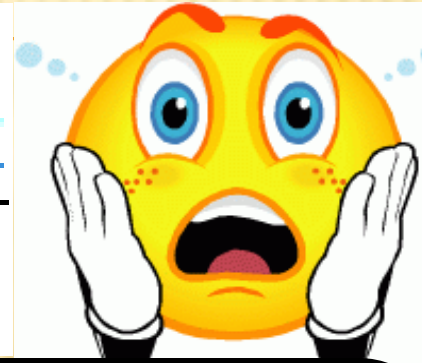


Chart 3. Lorenz Curve for % Foundation Funds & Property Taxes Per Student



Gini Coefficient Formula & McLoone Index

$$G = \frac{n + 1}{n} - \frac{2 \sum_{i=1}^n (n + 1 - i) x_i}{n \sum_{i=1}^n x_i}$$



A Gini Coefficient of 0.10 or smaller is considered desirable. Both funding variables in the BLR study are 0.06.

Another popular equity measure, the McLoone Index, is the ratio of the sum of per-pupil revenues for all districts below the 50th percentile (or median revenue) to the sum of the same districts if their revenue equaled the median.

The McLoone Index also is unaffected by the economy and state characteristics, but it only addresses the districts that fall below the median revenue. A McLoone Index of 0.95 or larger is desirable. In the BLR study, the indexes are 0.96 for foundation + taxes and 0.95 for foundation + other adequacy funding.

McLoone Index

$$\text{McLoone} = \frac{\sum \text{Revenues of Districts} < \text{Median}}{\# \text{ of Districts} < \text{Median}(X) \text{ Median}}$$

Example of McLoone Scatter Plot

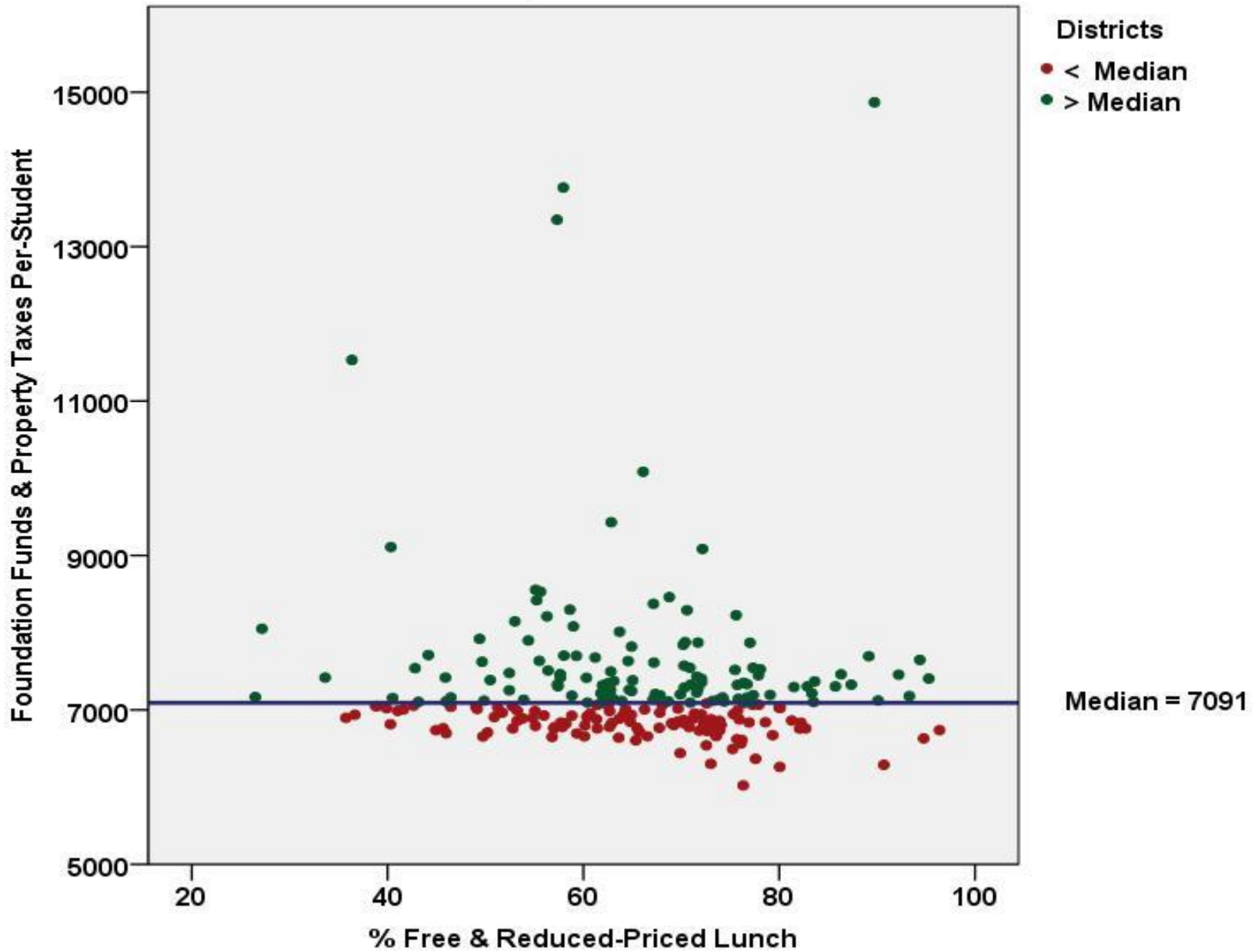


Table 1. Foundation Funding and Property Taxes per Student

Horizontal Equity	2013	2014	2015
Mean	6,921.70	7,097.82	7,333.49
Median	6,690.80	6,846.50	7,091.44
Restricted Range	1,818.62	2,072.56	1,851.87
Federal Range Ratio	0.29	0.32	0.28
Standard Deviation	1,125.01	1,334.05	1,253.89
Coefficient of Variation	0.16	0.19	0.17
McLoone Index	0.963	0.955	0.963
Gini Coefficient	0.056	0.055	0.056

Table 2. Foundation and Other Adequacy Funding per Student

Horizontal Equity	2013	2014	2015
Mean	7,706.64	7,878.18	8,106.74
Median	7,415.93	7,659.87	7,842.60
Restricted Range	2,390.70	2,487.43	2,371.17
Federal Range Ratio	0.39	0.39	0.33
Standard Deviation	1,125.01	1,210.55	1,308.91
Coefficient of Variation	0.15	0.15	0.16
McLoone Index	0.958	0.948	0.954
Gini Coefficient	0.061	0.060	0.060

Fiscal Neutrality Statistics

Fiscal neutrality statistics are used to examine the relationship between property wealth and district revenue per pupil. An equitable distribution of revenue to school districts would indicate a limited if any relationship between property wealth and revenue.

The wealth neutrality correlation is the relationship between property wealth and district per-pupil revenues. Correlations vary between 0 and ± 1 , with lower correlations indicating less of a relationship.

The wealth elasticity statistic is a more precise measure than the correlation because it indicates the exact increase in district revenue associated with a dollar increase in property wealth.

Ordinary least squares regression is used to examine the amount of change in revenue with each dollar increase in property wealth.

Tables 5 & 6 show results excluding 8 districts in which the uniform rate of tax (URT) generates more than the foundation funding rate of \$6,521.

Table 3. Property Wealth: Foundation Funding & Property Taxes Per Student

Fiscal Neutrality	2013	2014	2015
Wealth Neutrality Correlation	0.85	0.83	0.89
Wealth Elasticity	0.000*	0.18	0.20

Table 4. Property Wealth: Foundation & Adequacy-related Funding Per Student

Fiscal Neutrality	2013	2014	2015
Wealth Neutrality Correlation	0.81	0.78	0.85
Wealth Elasticity	0.000*	0.17	0.19

Note: *0.000 = 0.000002 in Tables 3 and 4

Table 5. Property Wealth: Foundation Funding & Property Taxes Per Student [8 High Uniform Rate of Tax (URT) Districts Excluded]

Fiscal Neutrality	2013	2014	2015
Wealth Neutrality Correlation	0.65	0.59	0.71
Wealth Elasticity	0.10	0.10	0.11

Table 6. Property Wealth: Foundation & Adequacy-related Funding Per Student [8 High URT Districts Excluded]

Fiscal Neutrality	2013	2014	2015
Wealth Neutrality Correlation	0.50	0.49	0.56
Wealth Elasticity	0.10	0.10	0.11

Vertical Equity Statistics

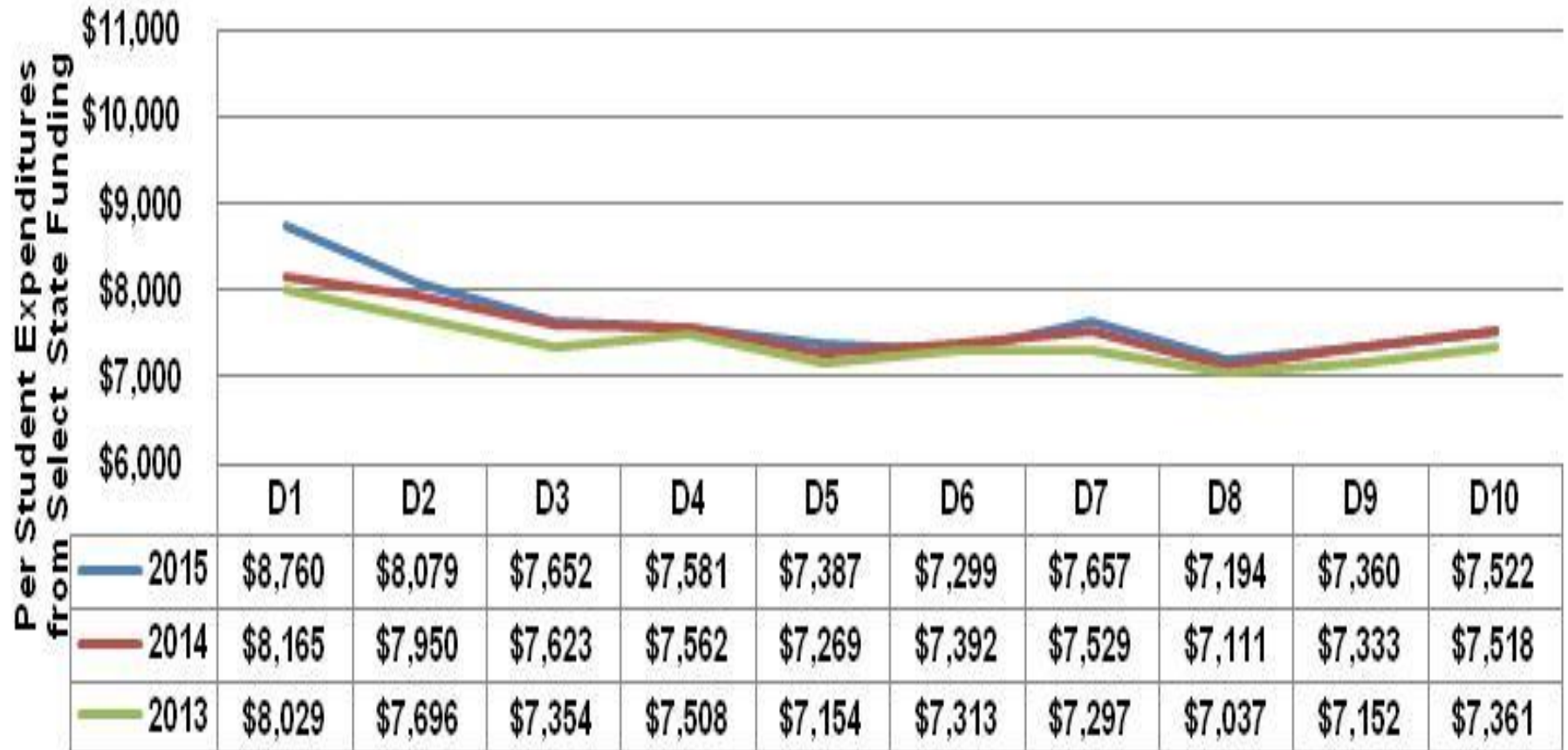
Vertical equity statistics are typically conducted on expenditures to assess the equity in spending according to key district characteristics.

The district characteristics addressed in this study are average daily membership (ADM), percent non-white, percent free and reduced-price lunch, and per-student property wealth.

The first vertical equity analysis (Chart 4) examines the relationship between “expenditures from select state-funding” and ADM. The two most prominent observations are the similarity in levels of expenditures across the 3 years shown, and the slightly higher per student expenses in the lower two ADM deciles.

These findings indicate that there is virtually no relationship (or inequity) between school size (or ADM) and per-student spending, with the exception of observable higher expenditures in smaller districts, which is to be expected because of the well-established economies of scale issues.

Chart 4. Expenditures from Select State Funding by ADM Deciles



Note; ADM deciles shown from Lowest (D1) to Highest (D10).

Vertical Equity Statistics

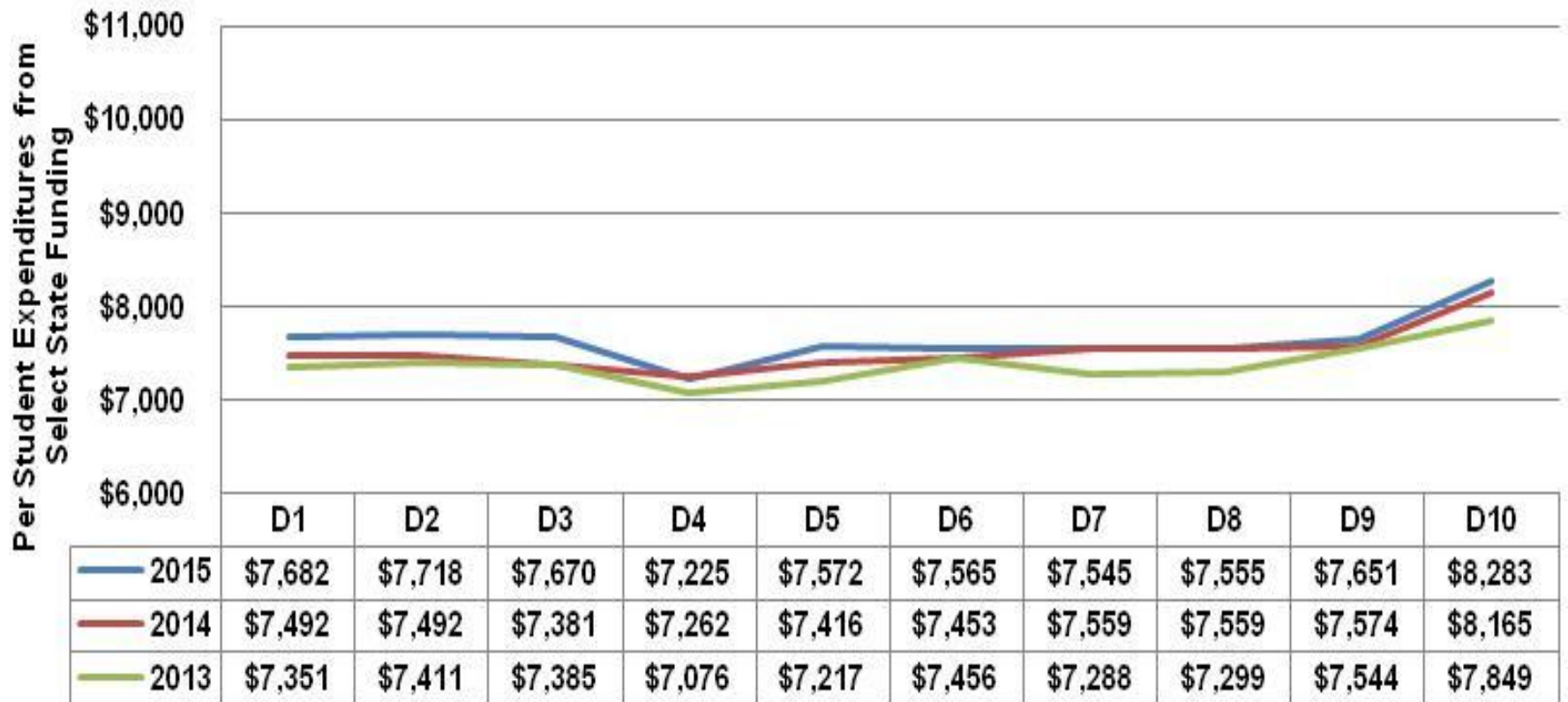
Chart 5 indicates that there is a perceptible increase in per-student expenditures in Decile10, or school districts with higher concentrations of non-white students. Otherwise, the spending patterns are commensurate across deciles and years.

The somewhat similar pattern of results in Chart 6, with free & reduced-priced lunch percentages, suggest that Charts 5 and 6 likely represent varied (or derivative) measures of high concentrations of poverty, which require additional expenditures for supplemental programs.

Chart 7 indicates a consistent pattern of per-pupil expenditures across deciles for all three years until decile10, which represents the highest property wealth per student.

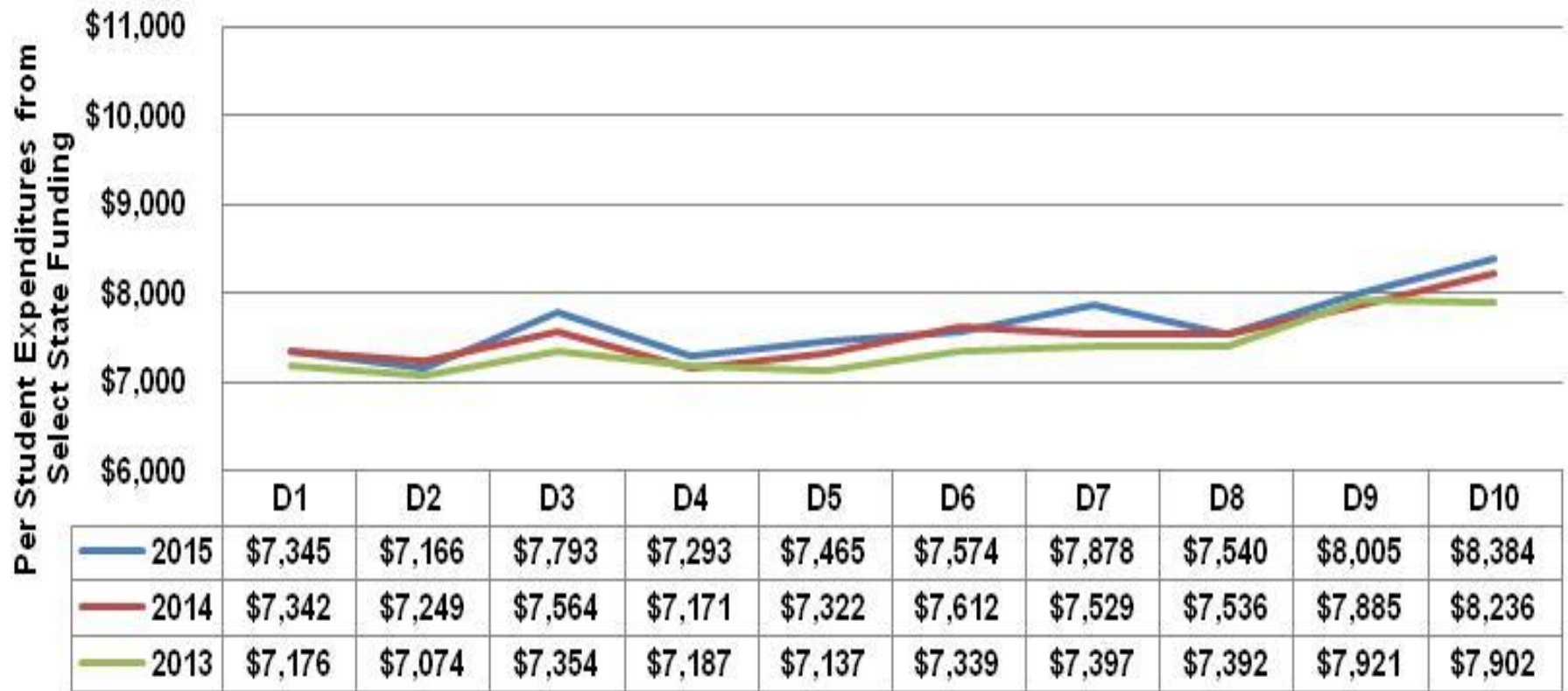
Decile10 is heavily influenced by 8 districts in which the uniform rate of tax (URT) generates more than the foundation funding rate of \$6,521. In effect, this means that these 8 districts have more revenue than the foundation rate set by the General Assembly.

Chart 5. Expenditures from Select State Funding by % Non-White Deciles



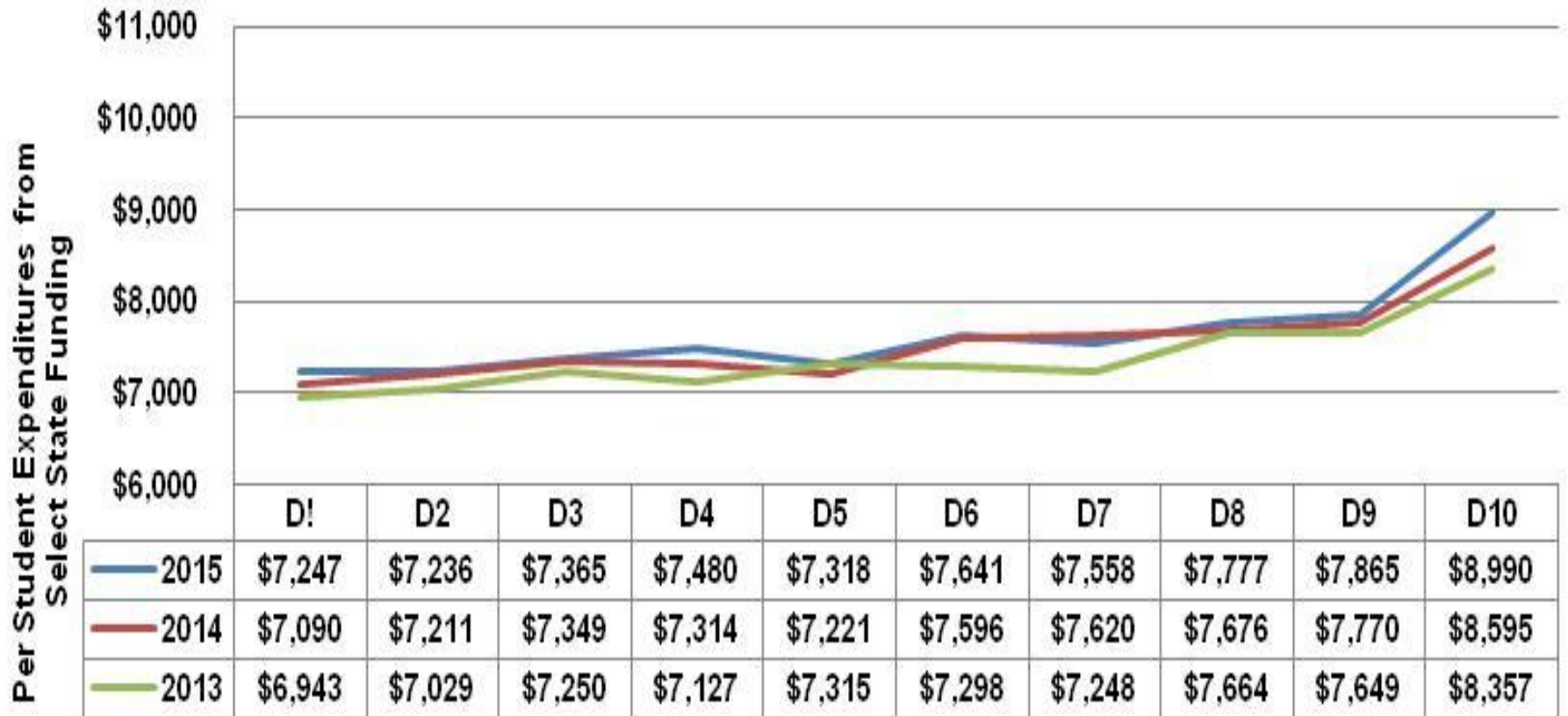
Note: % Non-White deciles shown from Lowest (D1) to Highest (D10).

Chart 6. Expenditures from Select State Funding by % Free & Reduced-Price Lunch Deciles



Note: % Free & reduced-price lunch deciles shown from Lowest (D1) to Highest (D10).

Chart 7. Expenditures from Select State Funding by Per-Student Property Wealth Deciles



Note: Per-student property wealth deciles shown from Lowest (D1) to Highest (D10).

Equity Statistics

The pattern of relationships between “expenditures from select state funds per student” for each district demographic shown in Charts 4 - 7 are nearly identical to the patterns observed between the same demographics and “total expenditures per student.”

For the sake of brevity, the vertical equity results for “total expenditures per student” are not presented in this power point presentation. However, these results are presented and discussed in the printed report.

Taken together, the horizontal equity analyses offer convincing evidence that Arkansas has maintained an equitable distribution of funding over the past three years.

The measures that are not influenced by the economy and state characteristics provide findings within the commonly accepted standards of equity.

Conclusions

The McLoone Index showed that districts in the bottom half of the funding distribution (on both variables) are funded at 95% of the funding that they would receive if they were funded the amount at the median (or 50% percentile).

The Gini coefficient indicates that the funding distribution in Arkansas is just 5% from perfect equity.

An examination of wealth elasticity shows that each dollar increase in per-student property wealth is associated with an increase of about 11 cents in both funding variables studied.

When district characteristics were divided into deciles, the vertical equity analyses revealed limited and relatively insignificant differences, with the exception of more spending in districts with higher concentrations of poverty and lower ADM. These latter findings are well-established results in the school finance literature.



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