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An Analysis of Fiscal Equity Provided by the JLARC System for Financing Public Schools: Commonwealth of Virginia 1987-88 to 1997-98

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Introduction

At the request of the Virginia Education Association (VEA), a 1990 study of the Virginia System of Public School Finance, *Closing the Gap*,[1] contrasted the level of fiscal equity achieved by the Commonwealth for school year, 1988-89, with prior year, 1987-88. The purpose of the *Closing the Gap* study was to determine whether the highly publicized Joint Legislative Audit and Review Commission (JLARC) study, *Funding the Standards of Quality, Part II: SOQ Costs and Distribution*,[2] implemented fully in 1988-89, fulfilled its promise to fund more equitably public elementary and secondary education throughout the Commonwealth than was provided by the previous state finance system, i.e., 1987-88.

Unfortunately, the equity analysis conducted for the 1988-89 school year contrasted with the 1987-88 school year showed that rather than an improvement, the level of equity actually deteriorated. Verstegen and Salmon said,

> ...disparities in education support have increased in the Commonwealth of Virginia following enactment of the new state aid system for elementary and secondary schools, and the relationship between a locality's ability-to-pay for education and revenue for education was strengthened. Thus, the new financing scheme, formulated to provide greater equity in education support was unable to mitigate large and increasing disparities in revenue for education between more and less affluent localities and a strong and growing linkage between revenue and wealth, i.e., ability-to-pay for education. The increasing disparities in revenue for education and the growing linkage between revenue and wealth raise serious questions concerning the equality of

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> educational opportunity afforded the nearly one million school children across the Commonwealth of Virginia. These data also suggest that the quality of education a youngster receives in Virginia is a function of the wealth of his parents and neighbors, rather than the wealth [of the] state as a whole.[3]

Since a decade had passed following implementation of the new state aid distribution system, commonly referred to as the JLARC formula, the Virginia Education Association decided that an equity analysis applied to school year 1997-98 data and contrasted to the 1987-88 school year was both appropriate and necessary. The results of the VEA's call for this analysis is included herein. Three fundamental questions were addressed:

- Have inter-division disparities in per pupil revenue been reduced?
- Is post-legislation revenue (1997-98) more equally distributed among pupils than pre-legislation revenue (1987-88)?
- Has the relationship between a locality's fiscal capacity, i.e., ability-to-pay for education, and its respective per pupil revenue for education diminished?

Measures and techniques established by school finance researchers and the various state courts were utilized to assess equity.[4] Three principal research findings emerged from the study: (1) the gap in funding for education between more and less affluent school divisions in the Commonwealth of Virginia widened immediately from pre-legislation law (1987-88) following implementation of post-legislation law (1988-89). While there has been a modest increase in the level of equity since 1988-89, the level of equity has remained substantially unchanged since 1987-88. (2) While all deciles of pupils experienced slight gains in total state and local revenue, when compared to pre-legislation law, the highest fiscal capacity school divisions (100 decile) experienced a 16.6 percent growth in state and local revenues under the new finance system, while the lowest capacity divisions (0 decile) experienced a more modest growth rate of 6.7 percent.[5] (3) The statistical relationship between fiscal capacity and revenue per pupil, already strong, grew still stronger; for 1987-88 the conduct of a regression equation accounted for 65 percent of the variance and by 1997-98, 76 percent of the variance was explained.

Presentation of Analysis

Each of the three research questions posed above was addressed pursuant to accepted measures and statistics. For research questions 1 and 2, a decile array of per pupil revenue was prepared and nine univariate equity statistics applied to the data. Displayed in Table 1 is the decile array and displayed in Table 2 are the results of the application of the nine equity statistics.

Revenue deciles are computed by ranking per pupil state and local revenue from low to high and then specifying total revenue per pupil at ten percent intervals. As the shape of the per pupil revenue distribution becomes more level, equity increases. The decile array is presented in five (5) columns; the first column presents the ten deciles, each decile, other than the zero decile, contains approximately 10 percent of the pupils of the Commonwealth. Note, however, that Fairfax County/City, due to its extraordinary size, spans the eighty and ninety deciles. The second column presents for each decile the mean per pupil state and local revenues for 1987-88 in nominal dollars. In column three the 1987-88 dollars are adjusted to 1997-98 real dollars in order to account for the effects of inflation. Column four contains the mean per pupil state and local revenues for 1997-98

presented in nominal dollars. Finally, presented in column five are percent changes that occurred for each decile from 1987-88 real dollars to 1997-98 nominal dollars. Except for the one-hundred decile, rather modest increases in per pupil state and local revenues were registered. However, primarily due to the heavy dependence on local resources, those school divisions characterized as high fiscal capacity and contained in the tenth decile recorded nearly a seventeen percent increase in real dollars from 1987-88 to 1997-98.

As mentioned earlier, Table 2 contains the results of the application of nine equity statistics to the data for school years 1987-88 and 1997-88. Each statistic is explained and the results presented below:

1. The Range - The range in revenue is the difference between the highest and lowest revenue per pupil in the state. As the range decreases, equity increases.

The nominal range, unadjusted for the effects of inflation, increased

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Table 1

A Comparison of Revenue Deciles Under Prior Law (1987-88) and Current Law (1997-98): Commonwealth of Virginia

	Prior Law		Current Law	% Change
Revenue Decile:	1987-88 (nominal)	1987-88[b] (real)	1997-98 (nominal)	1988-1998 (real)
0%	$2,654	$3,630	$3,873	6.7
10	2,804	3,835	4,191	9.3
20	3,044	4,164	4,384	5.3
30	3,122	4,270	4,554	6.4
40	3,326	4,549	4,606	1.3
50	3,386	4,631	4,970	7.3
60	3,614	4,943	5,101	3.2
70	3,968	5,427	5,590	3.0
80	4,246	5,808	–[a]	–
90	–[a]	–[a]	7,296	–
100%	6498	8,888	10,365	16.6

NOTE: Authors' calculations. Includes total state and local revenue minus transportation and special education categoricals. [a] Fairfax spanned this decile. [b] Adjusted for inflation; 1998=100%. Chain type indicator, Bureau of Economic Analysis; academic year index, July 1998-June 1999=FY 1999.

Table 2

A Comparison of Univariate Equity Statistics Under Prior Law (1987-88) and Current Law (1997-98): Commonwealth of Virginia

Measure	Prior Law: 1987-88[b]	Current Law: 1997-98
Range		
Nominal	$3,844	$6,492
Adjusted[a]	$5,258	$6,492
Range Ratio	2.45	2.68
Restricted Range		
Nominal	$2,283	$3,367
Adjusted[a]	$3,123	$3,367
Restricted Range Ratio	1.84	1.80
Federal Range Ratio	0.84	0.80
Coefficient of Variation	23.16	24.12
Gini Index	0.1242	0.1218
Theil Index	0.0252	0.0266
Verstegen Index	1.2978	1.2939
Atkinson Index		
18	0.8895	0.8974
110	0.8722	0.8824
McLoone Index	0.9099	0.9262

NOTE: [a]Author's Calculations. Adjusted for inflation. 1997-1998, July-June = 100%. Chain type indicator, Bureau of Economic Analysis; N=968,143 (1987-8), 1,100,007 (1997-98); [b]For 1987-88 see: Verstegen, D. A. (1996). *Concepts and Measures of Fiscal Inequality: A New Approach and Effects for Five States*, 22 (FALL 1996), 145-160.

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from $3,844 per pupil for 1987-88 to $6,492 for 1997-98. When adjusted for inflation, the range increased from $5,258 per pupil for 1987-88 to $6,4926 for 1997-98. Both the nominal and unadjusted ranges increased, suggesting a decrease in the level of equity provided. The range ratios, i.e., ratio between the highest and lowest per pupil expenditure also increased from 1: 2.45 for 1987-88 to 1:2.68 for 1997-98.

2. The Restricted Range- The restricted range is the difference between the revenue per pupil at selected percentiles; for example, the difference in revenue per pupil at the 95th percentile and 5th percentile. As the restricted range decreases, equity increases.

The nominal restricted range, unadjusted for the effects of inflation, increased from $2,283 per pupil for 1987-88 to $3,367 for 1997-98. When adjusted for inflation, the restricted range increased from $3,123 per pupil for 1987-88 to $3,3677 for 1997-98. Both the nominal and unadjusted restricted ranges increased, again suggesting a decrease in the level of equity provided. The restricted range ratios remained relatively unchanged, decreasing from 1:1.84 to 1:1.80.

3. The Federal Range Ratio- The federal range ratio is the difference between the per pupil revenue at the 95th and the 5th percentiles, divided by the value at the 5th percentile. As the federal range ratio decreases, equity increases.

The federal range ratio declined modestly from .84 for 1987-88 to .80 for 1997-98, indicating a very small increase in the level of equity provided.

4. The Coefficient of Variation (CV)- The Coefficient of Variation is the standard deviation of a distribution divided by its mean, expressed as a percentage. The CV measures variability in a revenue distribution around the mean observation. As the CV decreases, equity increases.

The coefficient of variation8 increased from 23.14 for 1987-88 to 24.12 for 1997-98, indicating a significant deterioration of the level of equity provided.

5. The Gini Index- The Gini index indicates how far the distribution of revenue is from providing each proportion of pupils with equal proportions of revenue. This measures ranges from 0.0-1.0. As the Gini decreases, equity increases.

The Gini index decreased from 0.1252 for 1987-88 to 0.1218 for 1997-98, pointing to a very modest gain in the level of equity provided.

6. The Theil Index- The Theil index is an overall measure of variation in resource distribution across all observations. As the Theil index decreases, equity increases.

The Theil index increased slightly from 0.0252 for 1987-88 to 0.0266 for 1997-98, suggesting a modest decline in the level of equity provided.

7. The Verstegen Index- This index measures equity for the upper half of the revenue distribution only. It is expressed as the ratio of the actual revenue of all pupils above the median relative to the total revenue those pupils would receive if they were at the median per pupil revenue in the state. The Verstegen index ranges from 1.0 to over 2.0. As the Verstegen index decreases, equity for the upper half of the revenue distribution increases.

For 1987-88 the Verstegen index was 1.2978 and by 1997-98 had declined slightly to 1.2939, indicating that the Verstegen index remained virtually unchanged.

8. The Atkinson Index- The Atkinson index is based upon a function that converts a distribution of per pupil objects to a single number that measures the total welfare of the distribution. The welfare function simultaneously takes into account how much of the object each pupil receives and the level of equity among pupils. Larger values of the parameter I, as used herein, make the index more sensitive to pupils at the low end of the per pupil revenue distribution. The index ranges from 1.0 for perfect equity to 0.0 for absolute inequity. As the Atkinson index increases, equity also increases.

The Atkinson index set at I = 8, yielded 0.8885 for 1987-88 and 0.8974 for 1997-88, and when set at I = 10, yielded 0.8722 for 1987-88 and 0.8824 for 1997-98. Both calculations showed a modest improvement of the level of equity provided.

9. The McLoone Index- The McLoone index measures equity for the lower half of the revenue distribution only. It is expressed as a ratio of the actual revenue of all pupils below the median relative to the total revenue those pupils would receive if they were at the median per pupil revenue level in the state. The McLoone index ranges from 0.0 to 1.0. As the McLoone index increases, equity for the lower half of the distribution increases.

In contrast to the Verstegen index that measures the equity provided by the distribution of revenues above the state median per pupil expenditure, the McLoone index measures the level of equity provided for the lower half of the revenue distribution. The McLoone index increased from 0.9099 for 1987-88 to 0.9262 for 1997-98, suggesting a significant increase in the level of equity provided.

Contained in Table 3 are wealth neutrality statistics as applied to data for school years, 1987-88 and 1997-98. The purpose of these statistics is to determine how strong is the relationship between fiscal capacity and state and local revenues per pupil.

1. The Simple Correlation- It indicates the relationship between per pupil revenue and a locality's wealth, i.e., fiscal capacity. As the relationship between wealth and revenue decreases, equity increases as does fiscal neutrality.

The conduct of the Pearson Product Moment Coefficient of Correlation yielded a slightly higher positive relationship for the 1997-88 (0.87) than for the 1987-88 (0.81), indicating that the link between fiscal capacity as measured by the Local Composite Index, and the generation of revenue increased over the decade.

2. Regression- The percent of variation explained in per pupil total state and local revenue (the dependent variable) by local per pupil wealth, i.e., ability-to-pay (the independent variable). As the coefficient of determination decreases, equity increases, as does fiscal neutrality.

From 1987-88 to 1997-88, the percent of total state and local revenue per pupil explained by the fiscal capacity, as measured by the Local Composite Index, increased from 0.65 to 0.76, again indicating that the state and local revenues per pupil of the local school divisions were largely a function of their local ability-to-pay for educational services.

3. Slope- The slope indicates the magnitude of the relationship between a locality's per pupil ability-to-pay, i.e., wealth and revenue for education, in absolute terms. As the slope decreases, equity increases as does fiscal neutrality.

An index of fiscal capacity, such as the Local Composite Index, does not lend itself to the calculation for the slope of the equation.

4. *Elasticity*- Like slopes, elasticities specify the magnitude of the relationship between revenue and local ability-to-pay, i.e., wealth, but in terms of percentages rather than absolute units. The elasticity statistic is insensitive to equal percentage additions whereas the slope is not. As the slope decreases, equity increases as does fiscal neutrality.

An index of fiscal capacity, such as the Local Composite Index, does not lend itself to the calculation of an elasticity quotient.

Table 3

A Comparison of Wealth Neutrality Statistics Under Prior Law (1987-88) and Current Law (1997-88): Commonwealth of Virginia[a]

	Prior Law 1986-87	Current Law 1997-98
WEALTH[b]		
Correlation (r)	0.81	0.87
Regression (r2)	0.65	0.76
Slope[b]	n.a.	n.a.
Elasticity	n.a.	n.a.
F-Ratio	86.50	418.77
Probability	0.0001	0.0001

NOTE: [a]Includes total state and local revenue minus transportation and special education (SOQ & categoricals); [b]Local Composite Index (LCI) measures local ability-to-pay; slope and elasticity is not appropriately calculated using this index.

Summary

  The distribution of state and local revenues per pupil as displayed by deciles did not show a particular pattern of change from 1987-88 to 1997-98 for all deciles, excluding the 100 decile. The change for the 100 decile was a substantial increase of nearly 17 percent This rather static condition prevailed despite the implementation of the JLARC funding system first introduced in 1988-89. The application of ten equity statistics also did not reveal a particular pattern of change. Several statistics showed modest deterioration of the level of equity currently being provided by the JLARC relative to the level of equity that was provided by the prior system of school finance. Other statistics showed modest improvement in the level of equity provided from 1987-88 to 1997-98. In regard to the application of wealth neutrality statistics, the relationship between fiscal capacity and the generation of state and local revenues per pupil actually became stronger over the decade. The application of similar statistics to the JLARC system of school finance immediately following its implementation in 1988-89 revealed substantial deterioration of equity. Some improvement in the level of equity has occurred since 1988-89, but has only roughly reached the level of equity provided by the previous system (1987-88). As measured by these statistics, the JLARC system of school finance has not proven successful in raising the level of equity provided throughout the Commonwealth. This finding is particularly alarming since Virginia commonly is recognized as one of several states that operates highly disparate systems of public schools. The one million plus pupils who attend public elementary and secondary schools in Virginia deserve better.

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Endnotes

1. Verstegen, Deborah A. and Richard Salmon, *Closing the Gap.* (Richmond, Virginia: Virginia Education Association, 1990). Due to the absence of uniform data available from the Virginia Department of Education for the 1987-88 and 1997-98 school years, the 1987-88 data were reformatted to conform to 1997-98 and the equity analysis for 1987-88 recalculated. As a result, the 1987-88 statistics arrayed in the original 1990 report do not match precisely the statistics displayed in this report.

2. Joint Legislative Audit and Review Commission, *Funding the Standards of Quality, Part II: SOQ Costs and Distribution.* (Richmond, Virginia: Commonwealth of Virginia).

3. Op cit., p. 21-22.

4. See References.

5. Adjusted for inflation.

6. Adjusted to 1997-98 dollars.

7. Adjusted to 1997-98 dollars.

8. Calculated as a percentage.