

## CHAPTER 3: DESIGN AND METHODOLOGY

### I. Purpose

The purpose of this study was to develop an explanation for the volatile behavior of the Local Composite Index, Virginia's measure of public school division fiscal capacity. Specifically, the study seeks to identify the proportion of change or volatility in a school division's LCI value that is *not* due to independent local change in the fiscal capacity indicators, but rather to the subordination of local change to its relative relationship to all the other public school divisions in the Commonwealth.

The study was undertaken to accomplish the following primary objective:

To document and analyze the volatile behavior of the mathematical and structural components of the current formula for measuring Virginia public school division fiscal capacity, the Local Composite Index, over the period encompassing the Biennia 1984-86 through 1996-98;

A secondary objective was to quantify the proportions of the volatility attributable to local and state fiscal capacity change. Additionally, the composite effects of the LCI components, particularly the Local and State Standardized Indicators and the Local to State Ratios, will be explained as they relate to changes in a school division's LCI value.

### II. Research Design

#### *Phases of the Study.*

The research design was implemented in five phases:

1. **Literature Review.** Literature related to public school division fiscal capacity was reviewed:
  - To identify normative and procedural concepts important to the philosophical development of fiscal capacity.
  - To delineate the various fiscal models used across the United States in the determination of public school fiscal capacity.

- To examine components of ratios, means, indices, their applications, and criteria for evaluating their behavior.

**2. Local Composite Index Review.** Information was collected from various sources regarding the Local Composite Index and its components in order to review the current funding formula, its features, and its history. Detailed fiscal capacity data employed in the LCI for the Biennia 1984-86 through 1996-98 was collected for all public school divisions in the Commonwealth of Virginia.

**3. Database Development.** A relational database was developed to facilitate exploratory trend analyses and evaluation relative to the volatile behavior of the LCI and its components for the Commonwealth and its public school divisions. For the convenience of the researcher some analyses were organized according to Planning Districts.<sup>94</sup>

**4. Analysis.** An examination and analysis of three trends of Local Composite Index indicators was selected and undertaken:

- *Biennial Change Rate* of the Indicators, Local and State
- *Biennial Change Rate* of the Standardized Indicators, Local and State; and
- *Net Biennial Change Rate* of the Local to State Ratio for the Standardized Indicators

**5. Case Studies.** An analysis of the Commonwealth of Virginia and five case studies of selected Virginia public school divisions were performed in order to provide an in-depth, representative analysis of the interaction resultant effects of the various Local Composite Index components. The Virginia public school divisions in the case studies included Carroll County, Fairfax County, Loudoun County, Buena Vista City, and Hampton City.

***Period of the Study.***

The Commonwealth of Virginia utilizes the biennium period for the implementation of its budget. The Local Composite Index also is implemented by the Virginia General Assembly on a

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<sup>94</sup> Displayed in Volume II: Technical Appendix, Appendix H are the public school divisions according to their Planning District.

biennial basis, and this study encompassed the Biennia 1984-86 through 1996-98. The study encompassed two periods of national recession, 1981-1983 and 1989-1991. These two recessions proved important for the conduct of this analysis, because it was during the periods of economic contraction that the Standardized Indicators employed by the Local Composite Index exhibited substantial differential interactions and variations in their Biennial Change Rates at both the local and state levels.

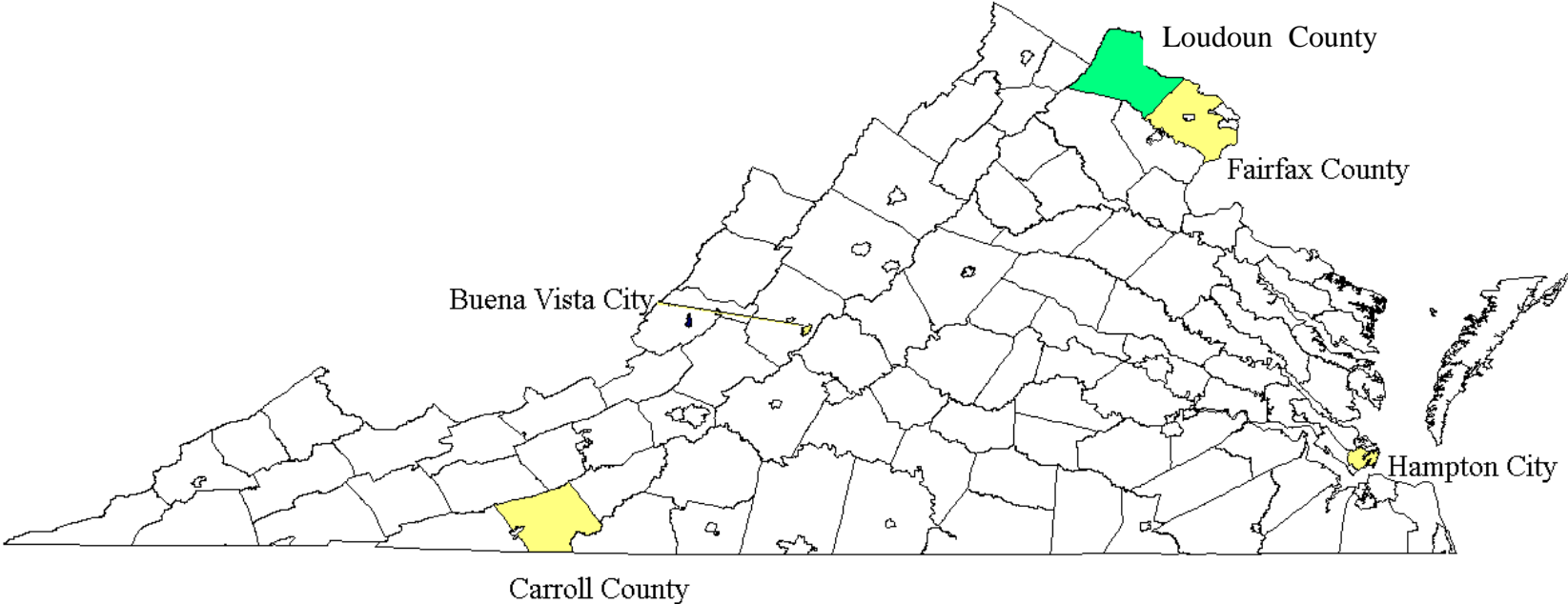
***Population of the Study.***

The population of the study was considered in two parts, which was congruent with the structure of the Local Composite Index. In the LCI for each of the six Local to State Ratios local school division indicator values comprise the numerators, and the Commonwealth of Virginia indicators comprise the denominators. Because the denominator was common for all school divisions including each of the five school divisions that were case studied, the explanations for the behavior of the State were documented initially. Next, five public school divisions in Virginia were analyzed individually, accounting for the unique interaction of the State (or denominator) on each locality case studied. The five school divisions were selected to provide representativeness among other Virginia public school divisions with respect to size (average daily membership), geographic location, city or county governmental structure, Local Composite Index, and apparent degree of volatility.

***Plan of the Study.***

The study was organized into two sections: Volume I as a Summary Document and Volume II as an extensive Technical Appendix (available from this author). To facilitate cross-comparison and to enhance the conceptual utility each school division was written with a high degree of parallel structure among the analyses. Further, the study was designed to include numerous figures and tables in order to provide a conceptual understanding of the study analyses, which is expected to be read by a wide audience. The length of the resultant study was voluminous, when the appendix is included. However, while voluminous, a wealth of information is included, particularly in Volume II, and together with Volume I, it builds a thorough, yet conceptual, analysis.

Map 3.1 Geographic Location of Virginia Public School Divisions Analyzed in Case Studies



### III. Collection of the Local Composite Index Data

#### *Types of Data Collected.*

The Local Composite Index data were collected for seven biennia extending 1984-86 through 1996-98 from the *Superintendent's Report* and *Facing Up*<sup>95</sup> published by the Virginia Department of Education, Richmond, Virginia for the base years inclusive in the appropriate biennia by Virginia local public school division. Amendments produced by the Virginia Department of Education to these data, when available, were transcribed to the data set. The following categories of Local Composite Indices indicators were collected:

- Virginia True Valuation of Real and Public Service Corporations Property Base  
(Base Years 1981, 1983, 1985, 1987, 1989, 1991, and 1993)
- Virginia Personal Income (Base Years 1981, 1983)
- Virginia Adjusted Gross Income (Base Years 1985, 1987, 1989, 1991, 1993)
- Virginia Taxable Retail and Use Sales Tax Receipts  
(Base Years 1981, 1983, 1985, 1987, 1989, 1991, and 1993)
- March 31<sup>st</sup> Average Daily Membership in Virginia Public School Divisions  
(Base Years 1982, 1984, 1986, 1988, 1990, 1992, and 1994)
- Virginia Resident Population  
(Base Years 1981, 1983, 1985, 1987, 1989, 1991, and 1993).
- Virginia Adjusted Gross Income (Base Years 1981 and 1983)<sup>96</sup>

#### *Special Adjustments to the Local Composite Index Data.*

There were two special adjustments to these data: (1) The interpolation of Personal Income to Adjusted Gross Income and (2) The calculation of a Standardized (across biennia) and Untruncated Local Composite Indices. Initially the Local Composite Index calculation employed personal income as one of its three measures of fiscal capacity and did not employ Virginia Adjusted Gross Income (AGI) in its computation, until the 1988-90 Biennium. The utilization of Personal Income for the Biennia 1984-86 and 1986-88 did not display a smooth transition into the AGI beginning with the 1988-90

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<sup>95</sup> The last copy of *Facing Up* was printed in 1989.

<sup>96</sup> Obtained from the Weldon Cooper Center for Public Service, University of Virginia.

Biennium. Personal Income is a broader measure than AGI, thus the Personal Income values for 1986-88 Biennium were considerably higher than the AGI for 1988-90, which created a large synthetic decrease in the percentage change over these two biennia. Therefore, a ratio index that interpolated a value of AGI of the same proportion as the Personal Income for the appropriate biennium and school division was applied to these years. Volume II: Technical Appendix E: Personal Income to Adjusted Gross Income Ratio Conversion, Biennia 1984-86 and 1986-88, lists the actual and computed values.

Second, utilizing the Local Composite Index formula as presented in Appendix B standardized (across biennia) and untruncated Local Composite Indices were calculated for each local school division. It is important to note that in the interest of standardization of the LCI across biennia such that variations in the magnitude of the LCI could be attributed to internal fluctuations of the local or state standardized indicators used in the formula, all calculations in this study were done with a Standardized Composite Multiplier of 0.5. (In actual practice the Virginia General Assembly applied a decreasing composite multiplier either to specific biennia or fiscal years to gradually raise the state share of funding from 50 to 55 percent.) **Thus, the LCI values calculated and used by this study are not precisely consistent with the actual LCI calculated by the Virginia Department of Education as directed by the Virginia General Assembly.**

#### IV. Specialized Calculations

The Local Composite Index employs a "floating" denominator or base. The term "floating" denominator applies to the practice of recalculating the Standardized State Indicator anew for each biennium. This calculation effectively precludes the referencing of the numerator or Standardized Local Indicator to a fixed or moving averaged base for comparison across biennia. However, in practice and for budgetary purposes the LCI is compared across biennia; most directly with the biennium immediately proceeding the most recent calculation. Therefore, because the *volatility* identified in this study problem is derived from biennia to biennia comparisons of the LCI, an examination of the Biennial Change Rates was undertaken. Various calculations to include the standardization of the Local Indicators, the standardization of the State Indicators, the Biennial Change Rates of Local and State standardized Indicators, the Local to State Ratios of the respective Standardized Indicators, the Net Biennial Change Rate for the Local to State Ratios, and the proportion of the Commonwealth of the indicators were performed. To facilitate these comparisons to LCI from different biennia standardized and untruncated LCIs were computed.

***Standardized Local Indicator.***

The Local Composite Index indicators of True Value of Real and Public Service Corporation Property Tax Bases, Adjusted Gross Income, and Taxable Retail Sales and Use Tax Receipts Bases were standardized to Average Daily Membership and Resident Population for each school division for each biennium:

- True Value of Real and Public Service Corporation Property / Average Daily Membership,  $(TPV/ADM)_{Local}$
- Virginia Adjusted Gross Income / Average Daily Membership,  $(AGI/ADM)_{Local}$
- Taxable Retail Sales Receipts / Average Daily Membership,  $(TRS/ADM)_{Local}$ ,
- True Value of Real and Public Service Corporation Property / Population,  $(TPV/POP)_{Local}$
- Virginia Adjusted Gross Income / Population,  $(AGI/POP)_{Local}$
- Taxable Retail Sales Receipts / Population,  $(TRS/POP)_{Local}$

The total local school division indicator for each Base Year was divided by the number of pupils in average daily membership or the number of persons in total local resident population, as appropriate. These values were calculated to four decimal places, consistent with state practice.

***The Commonwealth of Virginia (State) Standardized Indicator.***

The Commonwealth of Virginia (State) Standardized Indicators of the Local Composite Index indicators of True Value of Real and Public Service Corporation Property Tax Base, Adjusted Gross Income, and Taxable Retail Sales Receipts were standardized to Average Daily Membership and Population for the aggregate sum of the individual school divisions for each biennium:

- Total Statewide True Value of Real and Public Service Corporation Property / Total Statewide Average Daily Membership,  $(TPV/ADM)_{State}$
- Total Statewide Virginia Adjusted Gross Income / Total Statewide Average Daily Membership,  $(AGI/ADM)_{State}$
- Total Statewide Taxable Retail Sales Receipts / Total Statewide Average Daily Membership,  $(TRS/ADM)_{State}$
- Total Statewide True Value of Real and Public Service Corporation Property / Total Statewide Population,  $(TPV/POP)_{State}$

- Total Statewide Virginia Adjusted Gross Income / Total Statewide Population,  $(AGI/POP)_{State}$
- Total Statewide Taxable Retail Sales Receipts / Total Statewide Population,  $(TRS/POP)_{State}$

The aggregate of the local school division indicators were divided by the number of pupils in average daily membership or the number of persons in total local resident population, as appropriate. The resultant value was equal to the indicator dollar value per unit (per pupil or per capita). These values were calculated to four decimal places, again in accordance with state practice. These computations are used in the calculation of the Biennial Change Rate.

***Biennial Change Rate (Local Indicator and Standardized Local Indicator).***

The Biennial Change Rate (BCR) was calculated for each Local Indicator and each Local Standardized Indicator for each biennial pair (referred to as Periods) as follows: Biennia 1984-86 to 1986-88, 1986-88 to 1988-90, 1988-90 to 1990-92, 1991-94 to 1994-96, and 1994-96 to 1996-98. The initial Standardized Indicator was subtracted from the final Standardized Indicator; then the quantity obtained was divided by the initial Standardized Indicator value. The quotient is then multiplied by 100 to obtain a percent.

This calculation was performed as follows:

$$\mathbf{BCR} = \frac{(\text{Standardized Indicator})_{final} - (\text{Standardized Indicator})_{initial}}{(\text{Standardized Indicator})_{initial}} \times \mathbf{100}$$

Where:

$(\text{Standardized Indicator})_{initial}$  = the value of this standardized local indicator in the prior biennium

$(\text{Standardized Indicator})_{final}$  = the value of this standardized local indicator in the latter biennium

Example:

$$\mathbf{BCR} = \frac{(0.7734 - 0.6904)}{0.7734} \times \mathbf{100} = \mathbf{10.732\%}$$



A BCR percentage calculated to three decimal places is obtained. The Biennial Change Rate may be positive or negative. A positive Biennial Change Rate of a Standardized Local Indicator suggests that the initial Standardized Indicator value is smaller in magnitude than the final Standardized Indicator value. A positive Biennial Change Rate may be possible due to any one of three circumstances:

- The substantive variable (numerator) increases, while the denominator remains constant.
- The base variable (denominator) decreases, while the numerator remains constant.
- Both the substantive variable and the base variable increase, but the substantive variable increases at a greater rate than the base variable.

A positive Biennial Change Rate of a Standardized Local Indicator suggests that the *initial* Standardized Indicator is larger in magnitude than the *final* Standardized Indicator. A negative Biennial Change Rate of a Standardized Local Indicator may be possible due to any of three circumstances:

- The substantive variable (numerator) decreases, while the denominator remains constant.
- The base variable (denominator) increases, while the numerator remains constant.
- Both the substantive variable and the base variable decrease, but the substantive variable decreases at a greater rate.

***Biennial Change Rate (State Indicator and Standardized State Indicator).***

The Biennial Change Rate was calculated for each State Indicator and each Standardized Indicator of the Commonwealth of Virginia for each biennial pair (again, referred to as Periods) as follows: Period I (Biennia 1984-86 to 1986-88), Period II (1986-88 to 1988-90), Period III (1988-90 to 1990-92), Period IV (1991-94 to 1994-96), and Period V (1994-96 to 1996-98). The Standardized Indicator for the State is essentially the State Mean. The initial Standardized Indicator then was subtracted from the final Standardized Indicator; and the quantity thus obtained was divided by the former Standardized Indicator. In order to express the statistic as a percent, the quotient was multiplied by 100.

This calculation was performed as follows:

$$\text{BCR} = \frac{(\text{Standardized Indicator})_{\text{final}} - (\text{Standardized Indicator})_{\text{initial}}}{(\text{Standardized Indicator})_{\text{initial}}} \times 100$$

Where:

$(\text{Standardized Indicator})_{\text{initial}}$  = the value of this standardized state indicator in the prior biennium

$(\text{Standardized Indicator})_{\text{final}}$  = the value of this standardized state indicator in the latter biennium

Example:

$$\text{BCR} = \frac{(0.7734 - 0.6904)}{0.7734} \times 100 = 10.732\%$$

The calculation is carried out to 3 decimal places in accordance with state practices. The Biennial Change Rate may be either positive or negative. A positive Biennial Change Rate of a Standardized Local Indicator may be possible due to any one of three circumstances:

- The substantive variable (numerator) increases, while the denominator remains constant
- The base variable (denominator) decreases, while the numerator remains constant
- Both the substantive variable and the base variable increase, but the substantive variable increases at a greater rate than the base variable.

A negative Biennial Change Rate of a Standardized Local Indicator may be possible due to any one of three circumstances:

- The substantive variable (numerator) decreases, while the denominator remains constant.
- The base variable (denominator) increases, while the numerator remains constant.
- Both the substantive variable and the base variable decrease, but the substantive variable decreases at a greater rate than the base variable.

***Proportions of the Biennial Change Rate.***

The Biennial Change Rate can be divided into the substantive or numerator proportion and the base or denominator proportion.

$$\text{Biennial Change Rate} = \text{Substantive or Numerator Proportion} + \text{Base or Denominator Proportion}$$

*Step 1: Determination of the Numerator Proportion (Indicator).*

The numerator proportion is the percentage that either True Real and Public Service Corporation Property Valuation, Adjusted Gross Income, or Taxable Retail Sales Receipts contributes to the Biennial Change Rate. The calculation is performed as follows for TPV/ADM:

$$\frac{\Delta [(TPV_{final} / ADM_{initial}) - (TPV_{initial} / ADM_{initial})]}{\Delta (TPV_{initial} / ADM_{initial})} \times 100$$

Where:

$$\Delta (TPV_{final} / ADM_{initial}) = \text{Final biennium TPV divided by initial biennium ADM}$$

$$TPV_{final} = \text{TPV value for the final biennium}$$

$$ADM_{initial} = \text{ADM value for the initial biennium}$$

$$ADM_{final} = \text{ADM value for the final biennium}$$

Note that this calculation is equivalent to the differences in the Standardized Indicators between two biennia, but holding the base (ADM) constant for the calculation of a special Standardized Indicator for final biennia, will provide the proportion of the Biennial Change Rate due to the substantive variable or numerator.

*Step 2: Determination of the Denominator Proportion.*

The denominator proportion is the percentage that either the Average Daily Membership or the Population uniquely contributes to the Biennial Change Rate. It is calculated by subtracting the numerator proportion of the Biennial Change Rate from the Biennial Change Rate. For example, if the numerator proportion of the Biennial Change Rate was 15.870% and the Biennial Change Rate was 10.732%, then the denominator proportion would equal 10.732% minus 15.087% or - 5.138%. A negative percentage indicates that the rate of change in the denominator acted in such a way to decrease or dampen the effect of the numerator change. Similarly, a 10.732% Biennial Change Rate evaluated with a 7.500% numerator proportion of the Biennial Change Rate equals 3.232%. This positive percentage indicates that the denominator i.e., average daily membership or population, enhanced the effect of numerator change.

A positive value for the denominator proportion of the Biennial Change Rate indicates a loss in either average daily membership or population that served to enlarge the Biennial Change Rate of the standardized indicator. A negative value for the denominator proportion of the Biennial Change Rate indicates a gain in either average daily membership or population that served to lower the Biennial Change Rate of the standardized indicator.

***Local to State Ratio (Standardized Indicator).***

The Local to State Ratio was calculated by dividing the Standardized Local Indicator by the Standardized State Indicator for the identical indicator series. Because the denominators are the same unit, a scalar ratio is obtained which depicts the local value as a proportion of the state value. These ratios were calculated for each school division to four decimal places. These ratio values ranged from 0.1000 to over 13.000.

The Local to State Ratio is the proportion that each school division comprises of the State Mean for that indicator series. For example, a school division with a Local to State Ratio of 0.2876 has 28.76% of the State Mean for that Standardized Indicator. A school division with a Local to State Ratio of 1.2565 has 125.65% of the State Mean for that Standardized Indicator. The state value in the denominator is equivalent to 1.0000 or 100 %.

The Local to State Ratio is used in this study to differentiate the local and state proportions of the Net Biennial Change Rate. Remember, earlier in the chapter the Biennial Change Rate was composed of two proportions: Numerator (Substantive variable) and Denominator (Base variable); that were summed.

***Net Biennial Change Rate (Local to State Ratio for Standardized Indicators).***

The Net Biennial Change Rate is predicated on the concept that the magnitudes and direction of the Local Biennial Change Rate and the State Biennial Change Rate are summative to produce a Net Biennial Change Rate. Depending upon the divergence in the direction and magnitude between the local and the state biennial change rates, the Net Biennial Change Rate can be positive or negative.

The Local Biennial Change Rate is calculated as the percentage difference between the initial and final Standardized Indicator. The State Biennial Change Rate is calculated as the percentage difference between its initial and final Standardized Indicators. A positive State Biennial Change Rate is assumed to be acting in the opposite direction from a positive Local Biennial Change Rate. That is, if it is assumed that the local rate is positive, then by mathematical logic the State rate must be the opposite in sign, or negative.

To understand why this assumption is necessary:

$$\text{NET BIENNIAL CHANGE RATE} = \text{LOCAL (Numerator)} + \text{STATE (Denominator)}$$

Remember, the

$$\text{LOCAL to STATE Ratio} = \frac{\text{LOCAL Standardized Indicator}}{\text{STATE Standardized Indicator}}$$

The Net Biennial Change Rate is the percentage change between two consecutive Local to State Ratios. It can be further proportioned into Local factors and State factors.

The Net Biennial Change Rate can be positive or negative depending upon the direction and magnitude of the Local and State Biennial Change Rates. If the denominator Biennial Change Rate is larger than the numerator Biennial Change Rate, then the Local to State Ratio will be smaller than the initial ratio. Conversely, if the denominator Biennial Change Rate will be smaller than the numerator Biennial Change Rate, then the Local to State Ratio is larger than the initial ratio.

### ***The Untruncated and Standardized Local Composite Index***

Two operations were applied to the Local Composite Index calculation to enhance the comparability of the school division LCIs across biennia. First, the LCI was untruncated. Rather than "holding constant" all LCIs that met or exceeded 0.8000, the calculations were "untruncated." Second, the LCIs were standardized across the biennia by multiplying the sum of the ADM and POP indices for each biennium by the Standardized Composite Multiplier (0.50).

### ***Proportion of the Commonwealth.***

The proportion of the Commonwealth was calculated for each of the three indicators: True Real and Public Service Corporation Property Valuation, Adjusted Gross Income, and Taxable Retail Sales Receipts, and the two standardization units: Average Daily Membership and Population. This value is obtained by dividing the local value for the indicator or standardization unit by the state (or Commonwealth) value.

**I. Indicator Data (Hampton City and the Commonwealth of Virginia)**

	<b>Biennium 1986-88</b>	<b>Biennium 1988-90</b>	<b>Biennium 1986-88</b>	<b>Biennium 1988-90</b>
TPV <sub>Hampton</sub>	\$2,018,379,000	TPV <sub>Hampton</sub> \$2,338,570,000	TPV <sub>State</sub> \$143,258,413,000	TPV <sub>State</sub> \$161,180,977,000
ADM <sub>Hampton</sub>	22,598	ADM <sub>Hampton</sub> 20,326	ADM <sub>State</sub> 982,353	ADM <sub>State</sub> 958,892

**II. Calculation of Standardized Indicator (Hampton City and the Commonwealth of Virginia)**

	<b>1986-88</b>	<b>1988-90</b>
(TPV/ADM) <sub>Hampton</sub>	= \$2,018,379,000 / 22,599 = \$89,317	(TPV/ADM) <sub>State</sub> = \$143,258,413,000 / 982,353 = \$145,832
(TPV/ADM) <sub>Hampton</sub>	= \$2,338,570,000 / 20,326 = \$115,053	(TPV/ADM) <sub>State</sub> = \$143,258,413,000 / 982,353 = \$168,091

**III. Calculation of Biennial Change Rate for the Standardized Indicators (Hampton City - Local and the Commonwealth of Virginia - State)**

Local Biennial Change Rate	$\frac{(TPV/ADM)_{Hampton\ 1988-90} - (TPV/ADM)_{Hampton\ 1986-88}}{(TPV/ADM)_{Hampton\ 1986-88}} = \frac{\$115,053 - \$89,317}{\$89,317} = 28.815\%$
State Biennial Change Rate	$\frac{(TPV/ADM)_{State\ 1988-90} - (TPV/ADM)_{State\ 1986-88}}{(TPV/ADM)_{State\ 1986-88}} = \frac{\$168,091 - \$145,832}{\$145,832} = 15.263\%$

**IV. Calculation of the Local to State Ratio for each Biennium**

1986-88	$\frac{(TPV/ADM)_{Hampton}}{(TPV/ADM)_{State}} = \frac{\$89,317}{\$145,832} = 0.6124$
1988-90	$\frac{(TPV/ADM)_{Hampton}}{(TPV/ADM)_{State}} = \frac{\$115,053}{\$168,091} = 0.6845$

**Figure 3.1: Sample Calculation of Biennial Change Rates and Net Biennial Change Rate**

**V. Calculation of the Numerator Proportion of the Biennial Change Rate**

$$\frac{(TPV_{1988-90} / ADM_{1986-88})_{Hampton} - (TPV_{1986-88} / ADM_{1986-88})_{Hampton}}{(TPV_{1986-88} / ADM_{1986-88})} = \frac{(\$2,338,570,000 / 22,598) - (\$2,018,379,000 / 22,598)}{(\$2,018,379,000 / 22,598)} = \frac{103,485 - 89,316}{22,598}$$

89,316 = 0.15864 OR 15.864% attributable to the positive change or gain in the numerator (in this example, TPV)

**VI. Calculation of the Denominator Proportion of the Biennial Change Rate**

Remember, (Numerator Biennial Change Rate) + (Denominator Biennial Change Rate) = (Biennial Change Rate)

∴ (Biennial Change Rate) - (Numerator Biennial Change Rate) = (Denominator Biennial Change Rate)

(Biennial Change Rate)<sub>1986-88 through 1988-90</sub> - (Numerator Biennial Change Rate) = 28.820% - 15.864% = 12.951% attributable to ADM loss

**VII. Calculation of the Net Biennial Change Rate (Local to State Ratio)**

$$\frac{(\text{Local to State Ratio})_{1988-90} - (\text{Local to State Ratio})_{1986-88}}{(\text{Local to State Ratio})_{1986-88}} = \frac{0.6845 - 0.6124}{0.6124} = 0.1177 \text{ or } 11.773\%$$

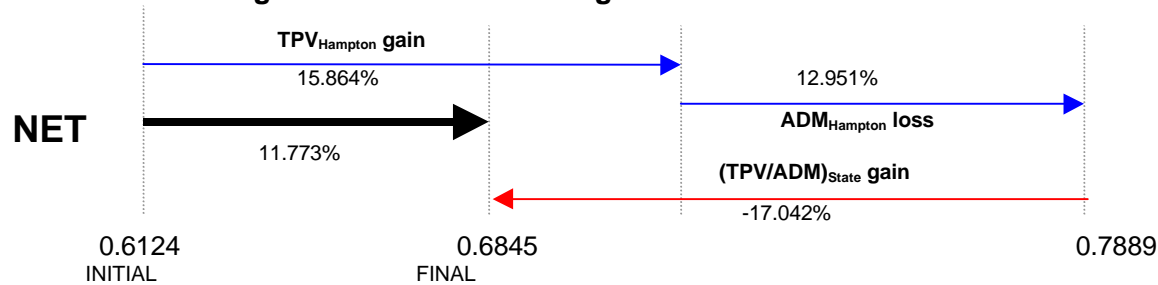
**VIII. Calculation of the State Proportion of the Net Biennial Change Rate**

Remember, Net Biennial Change Rate = Local Biennial Change Rate + State Biennial Change Rate

Thus, (Net Biennial Change Rate) - (Local Biennial Change Rate) = State Biennial Change Rate

11.773% - 28.815% = -17.042%

**IX. Construction of the Diagram: Net Biennial Change Rate: Interaction of Local and State Factors**



**Figure 3.1: Sample Calculation of Biennial Change Rates and Net Biennial Change Rate (continued)**