CHAPTER 2: REVIEW OF RELATED LITERATURE

Overview

The review of the related literature is organized into four sections. The first section defines fiscal capacity and its applications to public education finance. The second section traces the historical development of public school fiscal capacity measurement and evaluative criteria. Next, the Local Composite Index, Virginia's current measure of public school division fiscal capacity, is discussed. In conclusion, the mathematical characteristics of ratios, and indices are discussed.

I. Fiscal Capacity

This section explores how fiscal capacity has been defined, its approaches to public school funding, its relationship to fiscal effort, and evaluative criteria for fiscal capacity measures.

Definition.

An important function of all levels of government is their responsibility to raise revenue. The measurement of this ability to raise own-source revenue (usually through taxation) is commonly termed "fiscal capacity." The concept of fiscal capacity has developed predominately from an applied context rather than a strictly theoretical basis. This applied focus has influenced the measurement of fiscal capacity to consideration of the revenue that is raised pursuant to the tax bases actually utilized versus the configuration of tax bases and rates that could be theoretically employed to raise revenue.

There are two types of fiscal capacity: absolute fiscal capacity and relative fiscal capacity. Absolute fiscal capacity, proposed by Gurwitz, is a type of "long-run" fiscal capacity that is defined as the maximum present value of revenue that can be raised over time by the governments serving a given area. Gurwitz defined the "maximum sustainable revenue" as the amount of tax revenue a city or locality can raise over an indefinite period, without reducing the level of the tax base. This concept is indicative of the principle of neutrality.

25 Considerable debate has occurred relative to evaluating fiscal capacity pursuant to a government's actual tax base contrasted with evaluating capacity relative to the government's wealth and revenue indicators, regarding of whether the government has taxable access.

In contrast, relative fiscal capacity refers to a specific bounded period, usually the present fiscal period. It is determined by standardizing a jurisdiction's value of income, wealth, or some other measure of economic productivity to either a per pupil measure or a per capita measure. Relative fiscal capacity indicators have included income, property values, and sales tax receipts levied at average rates. Relative fiscal capacity is applied widely by state systems of public school finance.

Some researchers believe that there is no firm consensus on the “appropriateness” of alternative measures of fiscal capacity.\(^{27}\) The lack of agreement regarding its theoretical basis may be that definitions and research on fiscal capacity have evolved largely out of expedient application and the political nature of the environment in which fiscal capacity has been implemented. In his study of state fiscal capacity, Barro\(^{28}\) advanced six propositions comprising a theoretical definition of fiscal capacity:

1. Fiscal capacity is an attribute of an area, not a unit of government. All subordinate governments are to be considered part of the whole;
2. Fiscal capacity applies to own-source revenue;
3. Fiscal capacity is relative. The term capacity does not signify an absolute upper limit on the revenue a state can raise but pertains to the relative per capita revenue raised under specified conditions;
4. Fiscal capacity refers to nominal rather than real purchasing power;
5. Fiscal capacity refers to a single point in time; and
6. Fiscal capacity is independent of fiscal and economic choices.

These tenets of fiscal capacity theory exist within an operational constraint - the state-to-local budget tension - because local fiscal capacity is represented by the opportunities available to its constituency at a specific point in time. The state's budget constraint or purchasing power (and ultimately its fiscal capacity) is, thus ultimately, limited by the aggregate income of the state's residents and the extent to which the state could export the generation of revenue.

Barro, (referring to state fiscal capacity) defined fiscal capacity as, "...the relative per capita revenue that the state would raise, given its per capita economic income and its tax exportation rate,


\(^{28}\) Barro, 54.
if no federal aid existed, and if all other (noncapacity) influences were held constant at their national-average values.\textsuperscript{29}

**Relationship to Fiscal Effort.**

The concept of fiscal capacity is often confused with that of fiscal effort. However, the precise definition of fiscal effort is the extent to which a government utilizes its fiscal capacity to raise revenue. An equation delineating fiscal effort \((e)\) as local own source revenue divided by the local tax base is shown below.\textsuperscript{30}

\[
e = \frac{L}{B}
\]

Where: \( e = \) Local effort, \( L = \) Local own-source revenue, and \( B = \) Local tax base

This relationship is commonly illustrated by contrasting the perceived efforts of two communities with differing taxable bases. Wealthier communities often characterized as having access to extensive tax bases often utilize less fiscal effort (i.e.; have a lower tax rate) to support their schools. Whereas a less wealthy community with fewer tax bases would exert a much greater fiscal effort (i.e.; tax itself on existent bases at a much higher rate) to achieve a comparable degree of fiscal support.

**Criteria for Fiscal Capacity Measurement.**

States have applied various methods of fiscal capacity determination over the past several decades. However, school finance equity litigation spurred by the dramatic per pupil expenditure differentials that commonly result among school divisions within states have caused reexaminations of their equalization programs, and subsequently, their fiscal capacity formulae. Interestingly, there are few definitive studies delineating specific evaluative criteria of fiscal capacity formulae.

Parallel to the development of a systemic approach to financing schools was the initiation of publicly funded pupil transportation programs. Many school transportation studies outline evaluative criteria for state transportation funding formulae.\textsuperscript{31} Since pupil transportation programs must take

\textsuperscript{29} Ibid., 50.

\textsuperscript{30} Richard G. Salmon, personal communication.

into a school division's *ability* to transport given the characteristics of the school district, with some adaptation these criteria may, also, be applied to fiscal capacity formulae. The findings of selected studies are summarized below.

Featherson and Culp developed six criteria for the evaluation of state formulae for pupil transportation. First, the formula must take into account relevant economic, social, or geographic factors that may lead to inequality among districts. Second, the formula should be as simple, as possible, but maintain accuracy. The third criterion is that the formula must not be susceptible to local manipulation or control. The fourth criterion states that some degree of past experience be considered in the formula. The formula should be as objective as possible in that once defined, very few subjective judgements should be allowed in the implementation of the formula over time for the fifth criterion. Finally, the formula should promote efficient practice on behalf of the school district.

Johns, in a 1977 Florida school transportation study, outlined the following features as components of an effective transportation formula: equity, an efficient and adequate program, inflationary adjustments, simplicity, and full state funding for state responsibilities. Equity in state transportation funding programs was emphasized by Jordan and Hanes (1) the recognition of factors that contribute to inter-district variation such as school characteristics, geographic variation, and economies of scale, (2) the utilization of actual expenditure data, (3) variation in costs among different classifications of students, (4) a simple, accurate, and objective calculation, (5) the inability to be manipulated by individual entities, and (6) the promotion of efficiency.

In summary, criteria for public school funding fiscal capacity formulae might reasonably include:

- Simplicity - without intricacy or complexity
- Equity - impartial; horizontal equity and vertical equity.
- Adequacy - sufficient
- Objectivity - independent of extraneous influences
- Reliability - having the quality of stability over time
- Efficiency - producing the desired effect with a minimum of expense, redundancy, and waste.

The first four (simplicity, equity, adequacy, and objectivity) might be considered types of validity criterion as they address content of fiscal capacity formulae. The fifth (reliability) is as its
name, and the sixth (efficiency) may be considered an evaluative criterion of fiscal capacity. As it is the most important criterion to this study reliability will be discussed further.

Reliability is the degree that values or scores are free from errors of measurement. Generally there are two sources of errors in measurement: systematic and unsystematic (or random). Systematic errors recur upon repeated measurement of some criterion, and because they exert a consistent effect are not considered serious threats to reliability. Unsystematic or random errors cannot be predicted or compensated for in advance, and thus, are considered serious threats to reliability, when these errors affect the relative positions of the entities being measured.

Pedhazur and Schmelkin state that "reliability is a necessary, but not a sufficient condition for validity. That is, a measurement cannot be valid, if it is not reliable…" Thus, the reliability of a fiscal capacity measurement should be the foremost of all criteria to be satisfied. With regard to the Local Composite Index, it may be considered a reliable measure, if over time with repeated measurements, the relative LCI values of the school divisions did not vary.


34 Pedhazur and Schmelkin, p. 81.
II. Historical Development of Fiscal Capacity

As public schools developed from singular entities into consolidated systems throughout the states the methods of determining a constituency's ability to support these complex organizations evolved similarly. This section traces the concept of public school fiscal capacity beginning with colonial times through to its twentieth century adaptations. Concluding with a discussion of the Representative Tax System (RTS) it delineates the determination of a schools system's ability to pay as a complex and evolving process intimately linked to its purposes.

The Colonial Period: Community Fiscal Capacity.

During colonialism public school fiscal capacity was defined according to the number of households in a community and funds were apportioned based on the number of teachers. The first documented statements stipulating that a certain size community possessed an ability, and therefore, incurred the public responsibility to educate its children, are embodied in the legislation of the Massachusetts Bay Colony. A requirement that all towns in the Colony comprised of at least fifty householders must appoint and pay for a teacher of reading and writing was enacted in 1647. A rudimentary measure of fiscal capacity, “fifty householders”, was designated as sufficient capacity to support one teacher, rather than "fifty parents of school age children” indicating the broader public responsibility for support of education over the individual or private burden. This difference is significant, because it linked the sphere of a public fiscal capacity to extending beyond solely private ability and promoted a sense of social responsibility that served to benefit the entire society.

Subsequent laws enacted in the Massachusetts Bay Colony aligned fiscal capacity to initiatives to involve the benefits unique to economies of scale. Larger towns were expected to support comprehensive educational endeavors, such as the Latin Grammar School in Boston, Massachusetts. Incumbent upon towns with twice the previous capacity (100 householders) a Latin Grammar School was mandated by the Massachusetts Bay Colony with a penalty of five pounds for noncompliance. Clearly, the colonists were cognizant of the graduated ability to support its public schools within a community.

During the 1700s throughout New England, colonial legislatures authorized townships to divide into school districts with the delegation of certain duties and powers for their establishment. Systems of school finance in present day Connecticut, Maine, and New Hampshire have been


36 Maine was a part of Massachusetts for two hundred years. It became the 23rd state on March 15, 1820.
derived from these original townships. From this arrangement the public and local school district partnership of financing public education developed.

Unlike the homogeneous Massachusetts Bay Colony, the residents of the middle Atlantic colonies of New York, Pennsylvania, and New Jersey were diversified in their philosophies and religious outlooks. Perhaps due their desire to maintain distinctive traditions parochial schools were originally established and funded by rate bills. Yet, the first recorded act of state level funding of a public school occurred in 1768 in which Wyoming County, Pennsylvania was a recipient of grant of land from the state for the support of schools. Subsequently, in Pennsylvania the state legislature through the persistence of Thaddeus Stevens would establish a system of publicly funded schools in 1835.

It is important to note that the type of economy influenced the education system; the northern colonies with their commerce and manufacturing needed educated workers, whereas the southern colonies with largely agricultural interests had no such requirement, especially for slaves. Thus, the colonial public schools of the southern United States were patterned after the English model of private tuition-financed schools and church supported public schools. Locally supported public schools were largely "pauper" schools to educate the children of the poor. Johns noted that under this dual system educational opportunity was uneven and primarily a function of family wealth.

The Early Federal Period: Systemic Fiscal Capacity.

Throughout the colonial period fiscal capacity measurement as a public school finance instrument developed very slowly on a community by community basis. However, this pace was abruptly challenged upon the massive immigration in the latter half of the nineteenth century. Public education was pressured to become more diversified and extensive based upon a growing concern that education funded by the public at large seemed to provide many economic and social benefits to an Americanizing community. Due to the expanding immigrant population compulsory school attendance laws were enacted by many states.

It was the recognition of a need for a system of public education that encouraged the application of fiscal capacity rationale to the shared responsibility for funding schools in the 1870s.

37 A rate bill is a specialized tax levied on parents according to the number of children enrolled in the schools. An excellent review of this topic can be found in R. Freeman Butts and Lawrence A. Cremin, A History of Education in American Culture (New York: Holt, Rinehart and Winston, 1953).


A system of multiple grammar schools feeding into a new invention, the high school, necessitated a dependable and reasoned intergovernmental funding apparatus. Thus, the taxation instruments became the vehicles through which the public school infrastructure systemically extended itself.

During this period Horace Mann, who became Secretary of the Massachusetts State Board of Education, was extremely influential in educating others about the benefits accrued to a society by tax-supported public schools. The dilemma of whether or not to establish public supported schools and how they were to be funded was demonstrated in this letter from a Virginia legislator, R.B. Gooch, Richmond, to Horace Mann:

…There are a number of persons in this state who are deeply solicitous of doing something to remedy the evils under which our population are suffering from want of general instruction. They have determined to meet together in a deliberative assembly contemporaneously with the meeting of the State Legislature, in order to consult upon some system, which may meet the favor of that body. They have many opponents and much apathy to contend with, besides the natural obstacles presented by the sparseness of the population in our state and there are conflicting views among them as to the best mode of effecting the object they have in view. Some are in favor of raising the necessary means by state taxation and others by county levies; some for and some against the District school system; some are for adopting a general system operating everywhere whilst others are for submitting the question to the vote of the people…No tangible scheme has been presented…

This dilemma was typical of many legislative bodies during this period who considered the need for an educational system and what role the state should exercise in funding it. Initially, a derivation of the "householder's tax" or property tax became the vehicle to raise revenue, and later the property tax base upon which this tax was levied became a measure of fiscal capacity.

The tax-base approach to determining fiscal capacity utilized existing tax bases. These approaches frequently employed the property tax as the sole source of revenue. The property tax in most states is solely a locally levied tax.

Once the tax is collected at the local level, presumably it was used, in part, to support the public schools within its area of levy. Therefore, promulgating the belief that American public

---


41 In Virginia, the local property tax is segregated from state taxation. From the *Virginia Constitution, Article X, § 4*: Real estate, coal, and other mineral lands, and tangible personal property, except the rolling stock of public service corporations, are hereby segregated for, and made subject to, taxation only, and shall be assessed for local taxation in such manner and at such times as the General Assembly may prescribe by general law.

42 However, if a state mandates a certain tax rate for its school districts, it has, in effect, converted a local tax into a quasi-state property tax.
education is best served through local control, accountability, and support. Their thinking was predicated on an understanding that communities had differing "appetites" for various forms of public education, and that localities were best situated to address that desire. Thus, communities that placed a high value on a liberal education could appropriate more money towards that goal, whereas communities that had not yet cultivated such a "taste" for education could (at their discretion) spend less.

Almost immediately, the supposition that entirely local funding was the best method to fund public schools was confronted. The divergence in philosophies was advanced by the observation that some communities taxed themselves very heavily to raise only a small amount of revenue to fund their public schools, while other, wealthier, communities employed a lower tax rate and raised greater per pupil amounts of revenue. Thus, there was more involved in providing educational services than simply the desire or consistent effort expended for them.

**The Twentieth Century Period: The Rise of a Theoretical Basis for Fiscal Capacity.**

The development of fiscal capacity formulae in the twentieth century paralleled the continuation of the consolidation of schools with the rise of comprehensive systems extending from kindergarten through secondary levels. This vertical integration of education necessitated complex finance formulae that promoted equitable and reliable state funding among school districts.

The following decades witnessed an explosion of scholarly research on the financing of public schools. Their conclusions debated the perceived polemic of student equity versus efficiency, often with the assumption that fiscal effort contributed to fiscal efficiency, and that which was efficient was inherently fair.

In the wake of an urgent demand for a more equitable source of public school funding Ellwood Cubberly (1906) in his doctoral dissertation noted that “any attempt at the equalization of the opportunities for education, much less any attempt at equalizing tax [sic] burdens, it [sic] is impossible under a system of exclusively local taxation.” Cubberly determined that localities varied greatly in wealth and income. He noted significant disparities in fiscal capacity and taxing effort among the six states he included in his classic dissertation.

Concerned with taxpayer equity as well as equal opportunity for students to learn, Cubberly advocated the “flat grant approach.” This method guaranteed a certain dollar amount for every student (or teacher) in the local school division. Predicated on the assumption that a flat grant from the state would be ample and was politically feasible, this approach promised greater equity for both

---

the student and the taxpayer. Many state governments adopted this idea. Cubberly, also, suggested rewarding those public school districts (in particular poorer districts) for extraordinary effort in raising revenue, presumably through local increases in the level of taxation. To some scholars the rewarding of local effort was interpreted as contamination of the purpose of fiscal capacity per se.44 These individuals believed that fiscal capacity should be independent of how or to what extent that capacity was exploited, including through funding formulae administered by the state.

Later the concept of fiscal capacity would become similarly intertwined with concept of efficiency in the funding of public schools. Harlan Updegraff (1921) advocated the percentage equalization method that served as the foundation for the guaranteed tax yield approach.45 This approach "guaranteed" that the state would make up the difference between a local specified minimum level of expenditure and the money raised through a locally determined level of effort. If the locality wished to tax itself further even to fulfill what was considered the state's obligation, then that was at its own discretion. The oft quoted rationale for this effort-driven approach was that this "hands off" behavior of the state asserted the right of localities to establish their own level of spending for public education purposes. Eighty years hence, this philosophy finds expression in statements that claim that it is a low fiscal capacity community's "choice" to spend less on its public schools. This shared cost approach has not been widely implemented, however, eighty years hence, this philosophy finds expression in statements that claim that it is a low fiscal capacity community's "choice" to spend less on its public schools. Apparently ignoring that fiscal effort comes more easily to affluent systems, Updegraff in agreement with Cubberly, advocated providing money for poorer districts that showed greater effort than the more advantaged districts.46

Not all education finance theorists agreed with Cubberly and Updegraff's premises of rewarding fiscal effort with incentive grants. George D. Strayer, Sr. and Robert M. Haig disagreed that effort should be a part of a school district fiscal capacity formula. In stating that fiscal effort

44 Refer to the discussion on Strayer and Haig in this section.


46 Updegraff was the first to advocate that school district fiscal capacity or wealth be entirely eliminated as a factor in the determination of state basic aid. Coons advanced this concept fifty years later, named "district power equalization." See John E. Coons, William H. Clune III, and Stephen D. Sugarman, *Private Wealth and Public Education* (Cambridge, MA: Harvard University Press, Belknap, 1970).
should only be considered to the extent there should be an equalization of the tax burden on localities. Strayer and Haig argue:

…that a system of state aid may and should be used to achieve simultaneously the double object of equalizing the variations in economic resources of the various localities, and of rewarding such communities as make a special 'effort' in the direction of providing local school facilities. If the sums given to localities as rewards are so substantial that they result in a perceptible diminution of tax burden on the locality which makes the unusual effort, they tend to destroy the equality of the tax burden called for under the principle. Moreover, this does not take into account the origin of the funds which are distributed as "rewards." If…they come from a fund supplied by a state-wide taxes, it will normally mean that a locality which makes a special 'effort,' be it rich or poor, will profit at the expense of the other counties of the state, rich and poor. It is difficult to see how equality can be achieved under…an arrangement for rewards paid without regard for the economic strength of the locality receiving the bonus or the added burden upon other counties which are taxed to supply the funds from which the bonus is paid.47

This philosophical shift likely influenced the work of Paul R. Mort48, who in his 1924 doctoral dissertation suggested that objective and equitable measures of educational need should be used by the state legislature in determining the amount of equalization funding. In this landmark study Mort utilized regression statistics to estimate or predict the staffing needs per pupil based on the prevailing or "average" staffing practice in public secondary and elementary schools. He developed a standard of measurement utilizing weighted pupil costs through which the annual minimum cost per pupil of an educational program could be calculated. From these costs the total school district cost was computed and related to the minimum property tax rate that could support these expenditures.

One of the first studies to measure pure fiscal capacity as distinct from fiscal effort was done by Chism49 (1936) which measured the ability of states to raise revenue based on the Model Tax Plan.50 Derived from an empirical measure of educational need51 Chism developed an index of inter-


50 The Model Tax Plan was prepared by a committee of tax experts sponsored by the National Tax Association in 1933 in response to the inability of localities and states to raise revenue from personal income taxes during the period of the Great Depression, specifically the years 1930-1933. The Model Tax plan recommended three major taxes: a personal income tax levied by the state of residence, a tax on tangible personal property levied by the state in which the property is located, and a business tax levied by the states in which the business is conducted. These taxes were suggested, because it was believed that a drop in revenue resultant of any future
state fiscal capacity by calculating the value for the ratio evaluated as the amount of revenue raised per unit of educational need. Each state was ranked according to an index of relative ability and confirmed that the states differed substantially in their ability to support public schools.

Chism noted that some states must levy taxes for the support of education at several times the rates employed by other states in order to finance a specified program of education. He concluded that these differences in ability to support the public schools would not be removed, even if all states adopted and efficiently administered a modern system of taxation,

…it is possible to determine the number of dollars of tax revenue which the various states could reasonably have been expected to devote to the support of education and to arrive at indices of the relative ability of the states to finance education.52

A problem with Chism's study was that using tax rates as a measure of wealth was inherently flawed.

In another doctoral study completed by Cornell,53, who expressed frustration by the use of assessed real property valuation in public school districts without regard for the percent of the real property's equalized or true value, attempted to develop a technique for measuring the relative fiscal capacity of counties in New York State. Unlike earlier studies that assumed that fiscal capacity measures utilized only the existing tax bases, Cornell relied upon economic indicators as an alternative methodology to the use of real property valuation in determining local ability. Cornell utilized the multiple regression technique for an analysis, which employed from five to eight independent or predictor variables54 in various models to predict the value of a proxy for the total real property valuation of the counties in New York State. A ranked index of ability to pay was compiled from the predicted property valuation calculated for each county. Although the Cornell study was thorough, rational, and debated widely, it was not implemented in New York State.

---

51 Mort, 12.

52 Chism, 11.


54 Cornell, 64. These independent variables included total population, retail sales, motor vehicle registrations, production, number of individual income tax returns, number of residence telephones, savings deposits, and postal receipts.
The first economic index of taxpaying ability actually implemented to apportion state public school funds was adopted by the Alabama legislature in 1938. The index, developed by R.L. Johns, used economic indicators to include retail sales, automobile licenses, personal income, number of persons employed, and the value of agricultural products as independent variables in a multiple regression analysis to predict equalized real property valuations in lieu of taxpaying ability. Johns stated that this index actually had limited predictive ability, but it served a functional purpose, until better methods in the area of real property assessment could be developed. Oddly enough, this 1938 index is still used to apportion a small percentage of state aid.

Studies of fiscal capacity prior to 1936 assumed that "each dollar of wealth or of income in a state is available equally for taxation purposes." Chism disagreed and proposed that each state was faced with unique problems which would demand different tax structures, and thus, each state would require different measures of fiscal capacity. Influenced by Mort's utilitarian emphasis, the early fiscal capacity theory had exempted from consideration taxable bases that were not being currently exercised.

After World War II as the diversity of state and local tax bases expanded throughout the United States and as the federal government pursued a larger role in the general welfare of the states, the necessity for interstate comparisons grew. The federal approach to fiscal capacity determination had arrived.

---


56 Richard G. Salmon. Personal communication.

57 Chism, 5.

58 Refer to Section 8 of Article I (General Welfare Clause) in the *United States Constitution.*
The Federalism Period: The Representative Tax System.

Selma J. Mushkin and Alice M. Rivlin of the Advisory Commission on Intergovernmental Relations (ACIR) in 1962 reintroduced the tax base approach to the development of fiscal capacity measures in a study that established the principles and methodology of a "Representative Tax System" (RTS) or comparative approach to calculating the fiscal capacities of the fifty states.

The RTS defined the fiscal capacity (or tax capacity) of a state and its local governments as the amount of revenue that could be raised, if all state-local governments applied identical rates (or national averages) to their respective tax bases. The resulting capacity measure is a relative measure reporting the relative ability of a government to raise revenue under a hypothetically uniform structured tax system. By combining a variety of taxable resources the RTS provides a composite index of each state's fiscal capacity. This approach was a shift from earlier ones in that fiscal capacity was viewed as not simply an indigenous characteristic of a locality, but rather an indication of the economic strength of the government to collect this revenue.

Barro in a critique of the RTS index suggests that it is not an index of underlying economic resources, but an index of statutory tax bases, because the majority of the bases used are consumptive

---


60 Calculated from data by Barro, p. 72 in Advisory Commission on Intergovernmental Relations, *Tax Capacity of the Fifty States: Methodology and Estimate*. (Washington, DC, 1982) are the following tax bases and their weights:

- General Sales and Gross Receipts Taxes 0.235
- Selective Sales Taxes 0.119
- License Taxes 0.036
- Individual Income Taxes 0.192
- Corporate Income Taxes 0.061
- Residential Property Taxes 0.173
- Nonresidential Property Taxes 0.144
- Estate and Gift Taxes 0.009
- Severance Taxes 0.031

Note that this summary only distinguished between nine bases, however, there are a total of twenty-six tax bases within these summary taxes.

61 J. Richard Aronson, *Financing State and Local Governments* (Washington, DC: The Brookings Institution, 1986). This distinction is important and was explained expertly by Richard A. Aronson of the Brookings Institution as follows: For the national government the ability of the citizens to pay taxes and the ability of the government to raise taxes are the same. However, for state and local governments...people live and work in different jurisdictions and this may allow people to shift their taxes. Under certain conditions, state and local governments also may be able to export taxes to those living in other cities or states.

62 Barro, 70.
in nature. These statutory bases reflect patterns of consumption or economic preferences rather than pure resource availability or capacity.  

Most critics of the RTS method have based their challenges on the selection of specific tax bases. Mineral-rich states have contested its use, because the RTS makes these states appear wealthier than if the per capita income system is used to assess their fiscal capacity. In 1986 modifications were made to use actual rather than average tax rates for the analysis of severance capacity. Although this change has been ferociously debated in the United States, the RTS has never been implemented.

The RTS was reminiscent of the Model Tax Plan which assumed that a broad base composed of multiple taxes was preferential to a strategy that employed only a few bases. However, the RTS system differed from the Model Tax Plan, because it did not presume a specific plan for taxation across all states. Because most local school districts in the nation are legally constrained to rely solely on property tax revenue, the RTS methodology with its multiplicity of state tax bases did not specifically and accurately reflect the ability of local public school systems to raise revenue.

The RTS has served as a model to stimulate further research in its extensions of its assumptions to local level applications. Fraser (1986) adapted the RTS methodology as he studied the applicability of a similar average tax rate approach to develop a broader measure of Virginia public school division fiscal capacity.  

The RTS system has undergone a series of modifications since its introduction. In 1978 Halsted65 revised the ACIR tax estimates. Furthermore, many studies have been done contrasting the RTS with the per capita personal income system used by the federal government.  

The ACIR study heightened the debate whether the ability of a government to raise revenue from taxes constituted a potential action rather than the actual behavior of that government. In a critique of the RTS Akin reasoned that all taxes must be paid out of personal income and thus, are

---

63 Property tax may not be strictly considered a tax on property, but rather a synthetic figure calculated from personal income.


competitive with all other taxes. In effect, the payment of one tax may preclude the payment of another tax, and therefore, the simultaneous payment of average tax rates for all taxes as assumed by the RTS was invalid. Akin\textsuperscript{67} developed a measure of fiscal capacity similar to the RTS that utilized regression analysis to predict estimated tax rates for a jurisdiction under the assumption that the district would behave in a normative manner. There is some question whether Akin's model actually measures true fiscal capacity or the taxing "behavior" of a government. Because a locality's ability to raise revenue was inferred directly from its taxing behavior, thereafter, many researchers described these types of regression analyses as "behavioral approaches."

Along this line of relating fiscal capacity measurement to the \textit{behavior} of tax instruments in a jurisdiction Akin\textsuperscript{68} expanded his concept of competing factors for payment of taxes from only the public or governmental sector to include the private sector as well. He stated that given a base of resources in a community, funds are spent for a mix of public and private goods. He advanced a broad concept of fiscal capacity that included "direct redistribution" of taxes through the private sector and argued that such should be included as a component for the calculation of public school division fiscal capacity.

Ladd\textsuperscript{69} deviated from the ACIR approach that differentially weighted tax bases. She concluded through regression analysis that different types of real property, residential and non-residential, through their ability to be taxed at differential rates, make unique contributions to the ability and willingness of a locality to fund public education. Although some communities may have equal dollar amounts of aggregate tax bases, these communities may exhibit fiscal capacity differences based upon price and wealth elasticities. These elasticities affect the actual revenue that is or can be raised over time.


\textsuperscript{68} Akin, Estimates of State Resource Constraints, 65.

\textsuperscript{69} Helen F. Ladd, "Local Education Expenditures, Fiscal Capacity, and the Composition of the Property Tax Base," \textit{National Tax Journal} XXVIII (No. 4, 1975): 153.
III. Overview of Current Fiscal Capacity Formulae in Other Selected States

There are three basic approaches to public school finance: flat grants, matching of grants, and equalization programs. Flat grants are commonly employed by states in order to fund categorical needs such as pupil transportation, textbooks, instructional materials, educational television, and school food services.\(^\text{70}\) Flat grants are allocated on a per pupil basis and are not dependent upon the fiscal capacity of the school division. In Virginia the 1% State Retail Sales and Use Tax reallocated to localities on the basis of resident school age population is partially a type of flat grant.\(^\text{71}\) By statute,\(^\text{72}\) however, the 1% State Retail Sales and Use Tax is considered local revenue. While flat grants do provide additional funds for school divisions and provide some equalizing tendencies,\(^\text{73}\) they usually are counterbalanced by fewer dollars ultimately allocated through an equalization program.

All states, except Hawaii use funding structure to finance their public schools. Wherever equalization programs are employed, it is essential for the state to assess the wealth and/or tax paying abilities of their school divisions. Equalization programs have relied on fiscal capacity measures to various degrees depending at least partially on the type of state program, that is jointly financed. Ultimately, however, fiscal equalization programs are designed to allocate greater amounts of state aid per unit to low-fiscal-capacity school districts and lesser amounts per unit to higher-fiscal capacity school districts. These programs include foundation programs, guaranteed tax yield/base programs, percentage-equalization programs, district-power-equalization programs, and tier programs. Equalization programs rather rapidly replaced the flat grants as a primary mechanism for public school funding by the states.


\(^{71}\) There is debate, however, concerning whether the deducted 1% State Sales and Use Tax is in actuality a state flat grant or local revenue due to its "canceling out" effect on a school division's state allocation per pupil.

\(^{72}\) From the *Code of Virginia* § 8.1-638 the Sales and Use Tax [State Retail Sales and Use Tax] generated by the one percent Sales and Use Tax "shall be apportioned and distributed upon the basis as certified to the Comptroller by the Department of Education, of the number of children in each county and city according to the most recent statewide census…The revenue so apportionable and distributable…shall be considered as funds raised from local sources."

\(^{73}\) Flat grants only provide equalization in the sense that the taxes are collected statewide and are allocated on a per pupil basis, and also, on a statewide basis. Thereby, high capacity areas receive less than they are taxed; low capacity jurisdictions receive revenue amounts that are greater than their aggregate taxes paid.
Equalization formulae typically utilize some type of fiscal capacity measure for allocation of state funds. Fiscal capacity formulae vary according to two characteristics: the type of measurement indicator employed and the mathematical structure of the formula. This section briefly reviews the prevalence of various indicators among the states in fiscal capacity determination and attempts to present a categorization of the structural types of fiscal capacity formulae used in public school finance.

The type of measurement indicator most frequently utilized (24 states) is based solely on assessed property valuation.\(^{74}\) A small number of states (9) rely on a combination of assessed valuation of property and other revenue sources, excluding personal resources. Nine states, also, rely on a combination of assessed valuation of property and personal income, and five states use several economic indicators, including assessed valuation of property. These indicators have been applied individually or in combination with each other. Table 2.0 indicates the classification of these indicators employed by state governments in their determination of the wealth of a school district (or division).

---

\(^{74}\) Assessed valuation is loosely defined by this source. Most states "equalize" the valuation of their real property through rates, ratios, and other techniques.
TABLE 2.0: Classification of FY 1993-94 Fiscal Capacity Indicators Utilized by State Governments in Determination of State Basis Aid

<table>
<thead>
<tr>
<th>Assessed Property Valuation (only)</th>
<th>Assessed Property Valuation &amp; Other Revenue Sources (not including Personal Income)</th>
<th>Assessed Property Valuation &amp; Personal Income</th>
<th>Assessed Property Valuation &amp; Personal Income, plus Other Revenue Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>Alaska</td>
<td>Connecticut</td>
<td>Alabama</td>
</tr>
<tr>
<td>Arkansas</td>
<td>Indiana</td>
<td>Maryland</td>
<td>Missouri</td>
</tr>
<tr>
<td>California</td>
<td>Louisiana</td>
<td>Massachusetts</td>
<td>Nebraska</td>
</tr>
<tr>
<td>Colorado</td>
<td>Mississippi</td>
<td>New Hampshire</td>
<td>Tennessee</td>
</tr>
<tr>
<td>Delaware</td>
<td>Nevada</td>
<td>New Jersey</td>
<td>Virginia</td>
</tr>
<tr>
<td>Florida</td>
<td>New Mexico</td>
<td>New York</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>Oregon</td>
<td>Pennsylvania</td>
<td></td>
</tr>
<tr>
<td>Idaho</td>
<td>South Dakota</td>
<td>Rhode Island</td>
<td></td>
</tr>
<tr>
<td>Illinois</td>
<td>Wyoming</td>
<td>Vermont</td>
<td></td>
</tr>
<tr>
<td>Iowa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kansas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentucky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michigan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minnesota</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Dakota</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oklahoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Carolina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utah</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Virginia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wisconsin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total = 24</strong></td>
<td><strong>Total = 9</strong></td>
<td><strong>Total = 9</strong></td>
<td><strong>Total = 5</strong></td>
</tr>
</tbody>
</table>

1 States not included: North Carolina and Washington do not use a measure of fiscal capacity in their State Aid. Hawaii has only one school district, thus all State funding goes to that district.

The structure of fiscal capacity formulae exhibit wide variations, because each incorporates characteristics and adjustment factors unique to a particular state. Generally speaking, these formulae could be classified into three categories: Difference Method, Ratio Index, and Regression-Based.

**Difference Method.**

Most states utilize variations of this method in which the state identifies the number of mills each district can levy through various tax instruments (usually for school operating expenses). The local school district exercises that millage rate, and the state funds the difference between what the state considers the minimum revenue or expenditure to operate district schools and the amount of revenue that can be raised within a school district.

**Ratio Index.**

Rhode Island and Virginia employ ratios of the value of local indicators to the value of state indicators to form an index.\textsuperscript{75} These states have fiscally dependent school districts (divisions). Rhode Island utilizes equalized assessed valuation (EAV) of a community adjusted by median family income. The EAV per pupil is divided by the EAV wealth per pupil of the state as a whole. As described later in this chapter Virginia's fiscal capacity formula utilizes the local value of each of three indicators of fiscal capacity divided by the identical state aggregates. The indicators are true (equalized assessed) real and public service corporation property, adjusted gross income, and taxable retail sales receipts differentially weighted and summed.

**Regression-Based.**

Public school systems in Tennessee like Virginia are fiscally dependent upon their governing bodies; that is, these school divisions do not possess taxing authority to raise revenue. The Tennessee Advisory Commission on Intergovernmental Relations (TACIR) has been active in the area of local government fiscal capacity measurement since 1989. The TACIR formula for public school division fiscal capacity was adopted in 1993 by the Tennessee State Board of Education. This predictive model utilized regression analysis and included variables that measured local ability to pay, service responsibility, and the relative real tax burden. According to TACIR these factors represented important considerations:

- The ability to pay taxes.
- Differences in tax burdens.

\textsuperscript{75} In Rhode Island the local wealth factor is the equalized assessed valuation (EAV) of a community adjusted for median family income. The operations aid formula divides the wealth per pupil of a school district by the state as a whole.
• Differences in responsibility to provide tax revenue for education.

The TACIR public school division fiscal capacity index is determined by the following methodology:

1. By using multiple regression to develop an equation for fiscal capacity.
2. Calculating the local per pupil fiscal capacity from the equation.
3. Multiplying per pupil fiscal capacity by average daily membership for each locality, thus producing a total school division predicted fiscal capacity.
4. The index is then obtained by dividing the total fiscal capacity for the locality by the state total fiscal capacity. The index is the locality's percentage of state fiscal capacity.
IV. Public School Division Fiscal Capacity Measurement in Virginia: The Local Composite Index

This section discusses the Virginia public school fiscal capacity formula, The Local Composite Index, from its historical, methodological, and component perspectives.

Historical.

In 1971 the Commonwealth of Virginia adopted a new state Constitution. In Article VIII the provision mandating quality educational programs was as follows:

Article VIII, §1: Public schools of high quality are to be maintained. The General Assembly shall provide for a system of free public elementary and secondary schools for all children of school age throughout the Commonwealth, and shall seek to ensure that an educational program of high quality is established and continually maintained.

Article VIII, § 2: Standards of Quality; State and local support of public schools. Standards of quality for the several school divisions shall be determined and prescribed from time to time by the Board of Education, subject only to revision by the General Assembly. The General Assembly shall determine the manner in which funds are to be provided for the cost of maintaining an educational program meeting the prescribed standards of quality, and shall provide for the apportionment of the cost of such program between the Commonwealth and the local units of government comprising such school divisions. Each local unit of local government shall provide its portion of such cost by local taxes or from other available funds.

Therefore, the Standards of Quality (SOQ) in the Virginia State Constitution are funded through a method legislated by the General Assembly. Currently, this method involves an equalization formula that employs the Local Composite Index as its measure of public school division fiscal capacity.

---

76 The State Basic Aid distribution formula actually is not contained in the Code of Virginia. (Refer to Appendix B for the worksheet.) Instead, it is biennially restated in the Appropriations Act of the General Assembly. See, for example, House Bill 29 for the 1998 General Assembly, which amends the Appropriations Act of 1997.
**State Basic Aid Determination.**

Funds distributed to Virginia public school divisions in support of the SOQ are called State Basic Aid, which is calculated both separately and somewhat uniquely for each public school division. Funds are distributed as State Basic Aid for school division N according to the following formula:

\[
\text{State Basic Aid}_N = (1.0000 - \text{Local Composite Index}_N) \times (\text{SOQ}_N - 1\% \text{ Sales Tax}_N)
\]

Where:

- **State Basic Aid**<sub>N</sub>: Basic Aid in support of SOQ for a school division N
- **Local Composite Index**<sub>N</sub>: Local Composite Index for a school division N
- **SOQ**<sub>N</sub>: Cost of the Standards of Quality for a school division N
- **1% Retail Sales and Use Tax Receipts**<sub>N</sub>: State distribution of the 1% Retail Sales Tax earmarked for K-12 education for a Virginia public school division N<sup>77</sup>

The State Basic Aid formula was designed such that each locality funded a percentage of the Basic Aid costs through local resources based on its local ability to pay or fiscal capacity. The local school division fiscal capacity was represented by the Local Composite Index (LCI) value. Consequently, the State portion of Basic Aid is the difference between 1.0000 and a locality's LCI number. For example, if a school division LCI value was 0.4678, the State would pay 1.0000 - 0.4678 or 53.22% (0.5322) times the SOQ minus the 1% sales tax, of the costs. An example of an LCI calculation is shown in Appendix B.

**General Formula.**

The Local Composite Index appears to be patterned philosophically after the Representative Tax System (RTS). The RTS is constructed by determining the national-average tax rates applied to individual income, corporate income, retail sales, property, and other state-local tax bases. These average tax rates are then applied to the state's actual tax bases, and the relative per capita revenue is computed for each state at these calculated mean rates. Thus, the RTS index is a weighted sum of relative or average tax bases (Base<sub>LOCAL</sub> / Base<sub>STATE</sub> ratios) among governmental entities. Similarly, the Local Composite Index utilizes true value of real property, adjusted gross income, and sales

---

<sup>77</sup> This use of the 1% State Retail Sales and Use Tax Receipts in State Basic Aid determination demonstrates why it is neither strictly a state tax or strictly a local tax. The state sales tax lowers the total cost for both the state and local governments.
indicators, each weighted differentially according to the average proportions of these tax bases and revenue streams in the Commonwealth.

Most states employ equalization formulae in which property wealth forms the basis of public school division fiscal capacity determination. A few states combine property wealth with other tax bases and revenue streams to develop indices of fiscal capacity that parallels philosophically the Representative Tax System (RTS). Without exception, the purpose of a fiscal capacity measure is to permit the state to allocate state funds in an inverse proportion their individual school districts' abilities to pay. As mentioned earlier, the determination of public school division fiscal capacity in Virginia relies on an indexed measure entitled the Local Composite Index (LCI), which is based upon six weighted ratios of selected local indicators to aggregate state indicators.  

Virginia has been forced to develop a complex procedure to determine the fiscal capacities for its school divisions, since they are fiscally dependent upon appropriations from their local governing bodies. These local governing bodies have been granted a wide array of local revenue sources, thus making it inappropriate to rely on a single measure of fiscal capacity, regardless of whether the source is wealth, income, or other types of economic indicators. Aside from the 1% State Taxable Retail Sales and Use Tax Receipts redistributed to localities on the flat basis of school age population, and specifically, dedicated to public schools, town/city councils or county boards of supervisors have utilized with approval from the Virginia General Assembly, various taxes and user fees without expressly dedicating any other source or revenue combination toward public education purposes. Consequently, precisely identifying the fungible components of local tax revenue that are used to fund Virginia's public schools is futile. Since a diversity of revenue sources is employed at the discretion of their local governing bodies, the composition of the total local tax base appears

78 The weights for the LCI apply to the average proportions of these tax bases as they existed in the 1970s. It is unknown as to whether these bases actually are in the identical average proportion today.

79 Refer to Appendix B: The Local Composite Index Formula.

80 Fiscal capacity is a quantitative measure intended to reflect the resources a jurisdiction can tax to raise revenue for public purposes. For purposes of comparison among different jurisdictions, measures of fiscal capacity are often expressed on an amount per unit, such as per capita; when referring to public elementary and secondary schools; and on a per pupil basis most often designated by average daily membership, average daily attendance, or school age population. Generally speaking, fiscal capacity values purport to mirror the individual economic situation of a jurisdiction with respect to its revenue generating ability. In times of economic growth the capacity should increase, and conversely, in periods of economic recession the magnitude of fiscal capacity should retract. To do this effectively, fiscal capacity measures should be based on timely fiscal data, be directly related to accessible revenue, be measurable, and not be excessively volatile.

81 Refer to the Appendix A: Glossary for recent changes to the redistribution of Sales tax receipts to school divisions.
inconsistent and variable across the cities, counties, and towns that operate school divisions. This situation has promulgated the widely held belief that current local tax bases and their levies have not been uniquely reflective of the revenue potential exclusively available to Virginia’s school divisions.

The Local Composite Index is based upon three prevalent indicators of fiscal capacity: two tax bases (True Value of Real and Public Service Property and Taxable Retail Sales and Use Tax Receipts) and one revenue stream (Adjusted Gross Income) which are standardized to Average Daily Membership (ADM) and Population (per capita) units. From these revenue bases and stream six Standardized Indicators of fiscal capacity for each school division are developed biennially.

82 The concept of “true value” refers to the equalized or full market worth of locally taxed real estate or public service corporation in a particular jurisdiction. With regard to each of the designated property classes, the True Value of Real and Public Service Corporation Property data supporting these fiscal capacity calculations can be found in the annual Department of Taxation (DOT) Virginia Assessment / Sales Ratio Study. A secondary source tabulating these data is the Superintendent’s Annual Report for Virginia for the appropriate calendar years.

83 In the calculation of the fiscal capacity of a school division the total adjusted gross income (AGI) of a jurisdiction’s residents functions as a surrogate for specific resource bases to which the “other” revenue instruments of a locality are applied. In this study AGI refers to Virginia, not federal, Adjusted Gross Income. Derived from state income tax returns and reported by geographic or "zip" code Virginia AGI excludes most Social Security benefits and various other transfer payments, investment income retained by life insurance carriers and private uninsured pension funds, non-cash imputed income, tax-free interest and dividends, and the income received by “non-resident” military personnel stationed in Virginia. Additionally, jurisdictional AGI figures do not reflect the income of residents who are exempt from filing Virginia state tax returns. The primary source for this information is the Virginia Department of Taxation (DOT) document: Virginia Adjusted Gross Income, Taxable Year for the Fiscal Years 1984 through 1996. A secondary source for these data is the Superintendent’s Annual Report for Virginia for the Fiscal Years 1984 - 1996.

84 Income is not taxed at the local (city, county, or town) level. However, personal income (changed beginning with the 1988-90 Biennium to adjusted gross income) is used as a proxy for as many as twenty-two other possible sources of revenue available to local governments.

85 Referred to as “Standardized Local Indicators” in this report the six standardized indicators are True Value of Real and Public Service Corporation Property per Pupil in Average Daily Membership (TPV/ADM), Adjusted Gross Income per Pupil in Average Daily Membership (AGI/ADM), Taxable Retail Sales and Use Tax Receipts per Pupil in Average Daily Membership (TRS/ADM), True Value of Real and Public Service Corporation Property per capita (population) (TPV/POP), Adjusted Gross Income per capita (AGI/POP), and Taxable Retail Sales and Use Tax Receipts per capita (TRS/POP).
Local to State Ratios of Standardized Indicators.

Somewhat atypical of others in the nation Virginia’s fiscal capacity formula utilizes real property values, individual resident adjusted gross income (as a proxy for several revenue sources), and taxable retail sales receipts measures. Even more unique, the Virginia LCI expresses each of these standardized local indicators of fiscal capacity as a ratio to its corresponding standardized state indicators. The magnitude of each ratio reflects whether the particular school division has greater or lesser amounts of true value of property, adjusted gross income, or taxable retail sales receipts on both a per pupil and a per capita basis than the mean of the state in each of these six categories. A Local to State Ratio greater than one (1.0000) identified the school division as having more than the State Mean. Conversely, a Local to State Ratio smaller than one (1.0000) defined a locality with less of that indicator.

ADM and Population Indices.

To complete the LCI calculation the resultant Local to State Ratios for each standardization unit (average daily membership, population) are weighted (0.5 for property, 0.4 for adjusted gross income, and 0.1 for taxable retail sales and use tax receipts) and summed to form two composite indices: an Average Daily Membership (ADM) Composite Index and a Population (per capita) Composite Index. Finally, the ADM Composite Index is weighted two-thirds (0.6667) and the Population Composite Index is weighted one-third (0.3333). These products are summed and multiplied by a Composite Multiplier (ranging from 0.45 to 0.50 depending upon the state share determined by the Virginia General Assembly for the respective biennium) to arrive at the LCI value for a school division. Accordingly, a school division with a LCI index value lower than 0.5000

86 Referred to as “Standardized State Indicators” in this report the six standardized indicators are Statewide True Value of Real and Public Service Corporation Property per Pupil in Statewide Average Daily Membership (TPV/ADM), Statewide Adjusted Gross Income per Pupil in Statewide Average Daily Membership (AGI/ADM), Statewide Taxable Retail Sales and Use Tax Receipts per Pupil in Statewide Average Daily Membership (TRS/ADM), Statewide True Value of Real and Public Service Corporation Property per capita (Statewide population) (TPV/POP), Statewide Adjusted Gross Income per capita (Statewide populations), (AGI/POP), and Statewide Taxable Retail Sales and Use Tax Receipts per capita (Statewide population) (TRS/POP).

87 These weights are determined by the relative (average) contribution of taxes from these bases statewide at the time of the initial implementation of the LCI (Biennium 1974-76), not by the relative proportion of these bases specific to the respective localities. Thus, the resulting LCI are not consistent for those most changed localities.

88 For standardization purposes all LCI values used in this study were calculated by using 0.50 as a Standardized Composite Multiplier. From the 1974-76 Biennium through the 1986-88 Biennium the 0.50 Standardized Composite Multiplier was applied to the third or final algorithm, which mathematically merged he ADM Index and Population Index. Commencing with the 1988-90 Biennium, the 0.50 was incrementally decreased to 0.45 (Refer to Appendix D), thereby guaranteeing that 55% of the Basic Aid costs would be borne by the state and 45% by the individual localities. Thus, the values obtained and used for this study are not be consistent with the
(Biennium 1984-88), 0.4900 (Biennium 1988-90), 0.4700 (Biennium 1990-92), or 0.4500 (Biennium 1992-98) was identified as having less fiscal capacity than the Statewide average or mean.\(^8\)

Applicable only to school divisions with LCI values greater than 0.8000, the LCI was assigned an alternate or truncated value of 0.8000. This process of lowering the higher values has been referred to as truncation\(^9\) and ensured that all school divisions received a minimum of twenty percent of their State Basic Aid costs.\(^1\) This procedure effectively reduced the magnitude of the values actually calculated by the Virginia General Assembly on behalf of the school division for the respective biennia. Refer to Appendix D for a comparison of selected LCI values used in this study.

\(^8\) These discussions refer to untruncated Local Composite Indices. The State Mean is interpreted as that Statewide indicator value divided by the Statewide Average Daily Membership or Population. For example, the 1984-86 Biennium State Mean for True Valuation of Real and Public Service Property is the total statewide True Value of Real and Public Service Corporation Property $143,258,413,000 divided by the 982,353 pupils in Average Daily Membership in Virginia or $145,831.91 per pupil in ADM.

\(^9\) When Local Composite Index values are greater than 0.8000, they are reduced or truncated to 0.8000. The intent of the State in applying this truncation was to ensure that all divisions receive a minimum of twenty percent of their Standards of Quality estimated costs in State Basic Aid. However, this truncation at the 0.8000 level decidedly favors high fiscal capacity districts. It has been suggested that alternatively, all the LCI values should be lowered proportionally, until the highest value equals 0.8000. This alternative method would effectively reapporportion the LCIs of low fiscal capacity districts to even lower values, and should provide a more realistic assessment of their abilities to fund education. McDowell and Elias have completed extensive analyses regarding the implications of the truncation on the distribution of public school aid. Please refer to the References section in this document.

\(^1\) Basic Aid SOQ costs minus the 1% State Taxable Retail Sales and Use Tax Receipts. Refer to Appendix B for the State Basic Aid worksheet.
range of the Virginia General Assembly calculated Local Composite Index. Three figures illustrate the LCI formula (Figure 2.1), the Local and State Standardized Indicators (Figure 2.2), and the Local to State Ratios (Figure 2.3).

**Independent Local Fiscal Capacity Determination.**

Through the application of the current Local Composite Index methodology a fiscal capacity coefficient independent to each public school division is never determined. In other words, rationalizing the local capacity indicators to their respective state averages before performing the mathematical weighting and summation operations in the LCI formula has the net result of subordinating any independent value of local fiscal capacity to that of a proportion of the State Mean. Consequently, each Local Standardized Indicator becomes only indicative of its current percentage of the State Mean for that indicator.
Figure 2.1: Calculation of The Local Composite Index
THE SIX STANDARDIZED LOCAL INDICATORS (shown in blue)
THE SIX STANDARDIZED STATE INDICATORS (shown in black)

Figure 2.2 : The Local Composite Index
THE SIX LOCAL TO STATE RATIOS

Figure 2.3 : The Local Composite Index
V. The Mathematical and Statistical Concepts Relative to the Components of the Local Composite Index

This final section discusses the mathematical characteristics of ratios and indices.

Ratio Theory.

A ratio is a numerical representation of a quantity that is standardized to some base. Structurally, a ratio divides one variable (the numerator) by a base or standard number (the denominator). When two variables are rationalized, the substantive variable is in the numerator and the variable, which serves as the standard for comparison is in the denominator. The ratio $x/y$ is then expressed as $x$ units per unit of $y$. Ratios express large numbers in terms of their units of comparison and effectively provide a "density" measurement.

Rationalization of data comes at the expense of some degree of precision loss. A comparison of the True Real and Public Service Corporation Property Tax bases of Carroll County with Fairfax County illustrates this phenomenon. For example, the statement that Carroll County has a True Real Property Tax base of $224,629 per pupil does not convey the size of the total tax base or the number of pupils that are used to calculate the ratios. However, the Carroll County per pupil value can be compared easily to the corresponding value of $572,664 per pupil for Fairfax County. To the extent that most uses of rationalized data are for comparison purposes, this level of detail precision loss usually is not significant. Ultimately, however, the loss of detail precision has to be regained in order to make the funding formula (of which the LCI is merely a component) sensitive to the fiscal needs of individual public school divisions in Virginia.

Changes in rationalized value maybe due to a change in the substantive variable (numerator) or in the base (denominator), or to both. For example, a change in the ratio for Carroll County True Property Tax base value per pupil may occur for the following reasons:

- a change in the substantive variable or the True Property Value base (numerator)
- a change in the base or the number of pupils (denominator)
- a change in both the True Property Value and the number of pupils (numerator and denominator)

To the extent that such changes may be relevant it is necessary to identify both the base data and the ratios derived from such data. Changes in the numerator or substantive data, while the denominator is constant, signify actual growth in the rationalized (or standardized) indicator. Changes in the
denominator or base data, while the numerator remains constant, signify synthetic\textsuperscript{92} growth in the ratio. Simultaneous changes in both the numerator and denominator signify both actual and synthetic growth to variable degrees in the ratio.

A major limitation of ratios involves the inherent structural ties to their base values. While ratio changes are proportional to changes in the unit values (in the numerator, the denominator, or both), the magnitude of a percentage change in a unit diminishes with the rise in the absolute value of these bases. The most famous example of this loss of effect is demonstrated by the following involving the same dollar amount of increase:

- $1.00 is an 100\% increase from $1.00
- $1.00 is a 50\% increase from $2.00
- $1.00 is a 25\% increase from $4.00
- $1.00 is a 10\% increase from $10.00
- $1.00 is a 1\% increase from $100.00

Next, consider the application in which the same absolute dollar amount of increase translates to different percentage increases depending upon the magnitude of the initial value.

- $20,000 per pupil is a 20\% increase from $100,000 per pupil
- $20,000 per pupil is a 5\% increase from $400,000 per pupil

With regard to fiscal capacity change smaller capacity localities thus will experience higher growth rates for an equivalent dollar amount of increase than localities possessing larger capacity increases. The caution in utilizing rationalized values is to consider percentage increases carefully, because smaller values can produce exaggerated effects. Furthermore, when indicators are interpreted, the property of ratios to rise faster (have higher percentage growth rates) from low starting levels can be documented.

\textsuperscript{92} Please refer to the Appendix A: Glossary for a definition of "synthetic change" related to Standardized Indicators in the LCI.
Index Theory.

The development of indices has been debated by statisticians and economists. Fisher developed the definitive text *The Making of Index Numbers* in 1922. Indexing data converts the absolute magnitude of the data to a relative change. Indexing brings components to a common scale and suppresses the absolute magnitude of the data to reveal only relative changes. There are two types of indices: simple and composite. Simple index numbers describe relative change in a single series. Composite or complex indices summarize into a single figure the net result of the relative changes of multiple series or groups The Local Composite Index is a complex index.

According to Fisher an appropriate index should incorporate five characteristics:

- Definition of Purpose - The choice of data series included, the base year(s), and the weighting system should be congruent with the stated intention of the index.
- Stable components - The definitions or parameters of the components should not vary over time period or geographic location.
- Base Period selection - The base period (fixed, moving average, floating) should be appropriate to the purpose.
- Weighting System - The weighting system should be reliable and equitable.
- Compression System - The compression system (proportional or truncated) should be reliable and equitable.

The transformation of numbers into an index stresses the size and direction of change. The magnitude of the base (denominator) interprets the rate of change.

---