



# Framework for Evaluating & Reforming Education Finance Systems

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# Framework for Evaluating & Reforming Education Finance Systems

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## Abstract

This paper presents a comprehensive framework for evaluating and reforming education finance systems to ensure equity, adequacy, and equal opportunity in publicly funded education. I summarize decades of conceptual work, explaining our evolving understanding of the role and purpose of school finance systems, leading to our current framing that the purpose of these systems is to deliver the resources necessary for schools to provide all children equal opportunity to achieve common, adequate outcome goals. I provide a two-part, four step sequence of empirical methods for 1) evaluating whether and to what extent current systems achieve this goal (Part 1: What is), and 2) (Part 2: What should be) calibrating or recalibrating a school funding system to better achieve this goal. I follow with a discussion of lessons learned from recent applications of our framework in U.S. states, in both elementary and secondary school systems and community college systems. I conclude with implications for the path forward for broader application of the framework.

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## **Introduction**

This paper provides a framework for evaluating and guiding the reform of education finance systems. I address education finance systems broadly as any taxpayer supported system for providing publicly accessible education, including but not limited to, public pre-kindergarten through higher and adult education programs in the United States, or elsewhere. While contexts vary, the concepts I propose here are universal. So too should be the methods for evaluating whether or not taxpayer financed education systems achieve their intended goals.

I begin this paper with an overview of conceptions of educational equity, adequacy and equal opportunity (Baker, 2018). Much of the framing on which I draw comes from literature on elementary and secondary education in U.S. states and exists in a context where state legislatures have adopted school funding formulas which provide state aid to local (county, municipal or other) taxing jurisdictions, where state aid combined with local (property) taxes fund the majority share of public schooling.

The inequities of those systems over time have been challenged in state courts, under state constitutional requirements. There exists no explicitly articulated education right in the U.S. Constitution, but each U.S. state constitution includes mention of children's education rights. These rights are inconsistently interpreted and unevenly enforced. But whether constitutionally mandated and judicially imposed or not, now more than ever, providing all children equal educational opportunity is the right thing to do and in the public interest, in the U.S. and globally.

Following the conceptual overview, I provide an empirical framework, consistent with the conceptions, for evaluating and guiding the reform of education finance systems. I conclude with a summary of lessons learned in recent analyses and issues for further exploration, applying the framework.

### **Conceptual Framework**

In 1979 Robert Berne and Leanna Stiefel synthesized conceptual frameworks from public policy and finance and evidence drawn from early court cases challenging inequities in state school finance systems to propose a framework and series of measures for evaluating equity in state school finance systems (Berne & Stiefel, 1999, 1984, 1979). Their work laid the foundation for subsequent conceptual and empirical developments regarding equity measurement applied to preK–12 settings. They used two framing questions: Equity of what? Equity for who? On the “what” side, they suggested that equity could be framed in terms of financial inputs to schooling, real resource inputs (such as teachers and their qualifications), and outcomes. Their framework, however, predated both judicial application of outcome standards to evaluate school finance systems and the proliferation of state outcome standards, assessments, and accountability systems first in the 1990s and then in the 2000s under No Child Left Behind. The “who” side typically involved “students” and “taxpayers”: a state school finance system should be based on fair treatment of taxpayers and yield fair treatment of students. Drawing on literature from tax policy, Berne and Stiefel adopted a definition of *fairness* that provided for both “equal treatment of equals” (horizontal equity) and “unequal treatment of unequals” (vertical equity). That is, if two taxpayers are equally situated, their tax treatment should be similar; likewise, if two students have similar needs, their access to educational programs and services or financial inputs should be similar. But if two taxpayers are differently situated (homeowner versus industrial or

commercial property owner), then differential taxation might be permissible; and, if two students have substantively different educational needs requiring different programs and services, then different financial inputs might be needed to achieve equity.

In recent decades, I and others have explained the shortcomings of horizontal and vertical equity delineations. First, horizontal equity itself does not preclude vertical equity; equal treatment of equals does not preclude the need for differentiated treatment for some (nonequals). Second, vertical equity requires value judgments that lead to categorical determinations of *who* is unequal and *how unequal* their treatment must be in order to be “equitable.” Differences in individual students and population needs don’t always fall into neat boxes; rather, they run along continua.<sup>1</sup>

An alternative, unifying approach is to suggest that the treatment is not the inputs the child receives but the outcomes that are expected of all children under state standards and accountability systems. In this sense, all children under the umbrella of these state policies are similarly situated and similarly expected to achieve the common outcome standards. Thus, the obligation of the state is to ensure that all children, regardless of their background and where they attend school, have equal opportunity to achieve those common outcome standards.

The provision of *equal educational opportunity* requires differentiation of programs and services, including additional supports—vertical equity. This input (and process) differentiation is toward a goal of equal treatment (treatment = outcome goals) rather than unequal treatment (treatment =

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<sup>1</sup> Nonetheless, laws—federal and state statutes and regulations—often try to put things into neat boxes, and conceptions of equity often intersect with legal claims that one group is not receiving equitable treatment when compared with another, thus requiring courts to consider how to remedy those inequities. Significant federal laws enacted in the 1970s operate under this model, applying categorical declarations as to who is eligible for different treatment and frequently requiring judicial intervention to determine how much differentiation is required for legal compliance. Regarding children with disabilities, see *Andrew F. v. Douglas County School District Re-1*, 137 S. Ct. 29 (U.S. 2016). Regarding children with limited English language proficiency, see *Issa v. School District of Lancaster*, no. 16-3528 (3d Cir. Jan. 30, 2017).

inputs). Further, if differentiation of programs and services is required to provide equal opportunity to achieve common outcomes, there exists a more viable legal *equity* argument on behalf of the most disadvantaged children not separately classified under federal statutes. Whether children fit neatly into the protected boxes identified in federal statutes does not alone determine whether those children require additional resources. The conception of equal opportunity to achieve common outcome goals has thus largely replaced vertical equity in the vernacular of K–12 equity analysis (Baker & Green, 2009, 2008).

### **Legal and Policy Context of U.S. States**

The late 1980s and early 1990s saw a shift in legal strategy regarding state school finance systems away from emphasizing achieving equal revenue across settings (neutral of property wealth) and toward identifying some benchmark for minimum educational adequacy. Some advocates for this approach saw it as politically infeasible for states to raise sufficient state aid to close the spending gap between the poorest and most affluent districts, meaning that achieving spending parity likely required leveling down affluent districts. Thus, a focus on a minimum adequacy bar for the poorest districts would alleviate this concern and potentially garner political support of affluent communities that no longer had anything to lose (Clune, 1994). Bill Koski and Rob Reich explain that this approach is problematic in part because minimum adequacy standards are difficult to define; also, when some are provided merely minimally adequate education but others provided education that far exceeds minimum adequacy, the former remain at a disadvantage. Further, the adequacy of the minimum bar is diminished by increasing that gap, because education is, to a large extent, a *positional good*, whereby individuals compete based on relative position for access to higher education and economic prosperity (Koski & Reich, 2006).

Others have adopted a more progressive “adequacy” view that focusing on state standards and accountability systems could hold legislators’ feet to the fire to provide sufficient resources for all children to meet those standards, and state constitution education articles could be used to enforce this mandate.<sup>2</sup> Under this more progressive alternative, equal opportunity and adequacy goals are combined. The state must provide equal opportunity for all children to achieve “adequate” educational outcomes. Funding must be at a sufficient overall level and resources, programs, and services must be provided to ensure that children with varied needs and backgrounds have the supports they need to achieve the mandated outcomes.

It remains important, however, to be able to separate equal opportunity and adequacy objectives both for legal claims and for empirical analysis. The adequacy bar can be elusive (Cover, 2001). State courts are not always willing to declare that adopted accountability measures and outcome standards determine the state’s minimum constitutional obligation. The state’s ability to support a specific level of adequacy may be subject to economic fluctuations (Rebell, 2011). Importantly, at those times when revenue falls short of supporting high outcome standards, equal opportunity should still be preserved: equal opportunity can be achieved for a standard lower than, equal to, or higher than the single adequacy standard (Baker & Green, 2009, 2008).

The practical implications of modern equity, equal opportunity, and adequacy conceptions are that school finance systems in U.S. States must strive to achieve two simultaneous goals: account for differences in the costs of achieving equal educational opportunity (to achieve desired

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<sup>2</sup> For example, Kansas’s constitution requires that the legislature “shall make suitable provision for finance of the educational interests of the state.” Those educational interests are articulated in standards adopted by the state board of education, which holds independent constitutional authority for the “general supervision of public schools.” Kansas courts have repeatedly held that the legislature’s obligation is to provide financing that grants all children equal opportunity to achieve those standards. See *Gannon v. State*, 368 P.3d 1024, 303 Kan. 682 (2016); *Gannon v. State*, No. 113,267 (Kan. June 28, 2016); *Montoy v. State*, 279 Kan. 817, 112 P.3d 923 (2005); and *USD NO. 229 v. State*, 256 Kan. 232, 885 P.2d 1170 (1994).

outcomes) across schools and districts and the children they serve; and account for differences in the ability of local public school districts to cover those costs. The first goal relates primarily to the sorting of students and populations by needs across local schools and districts, warranting substantially differentiated funding to provide equal educational opportunity, as well as to geographic differences in the costs of labor and other school operations. The second goal stems from the continued reliance on local property taxation to support that system. Because local jurisdictions vary widely in the revenue they can raise when applying common tax rates or effort, states must distribute aid to offset these discrepancies, to achieve dollar parity.

### **Empirical Framework for Supporting Children’s Education Rights**

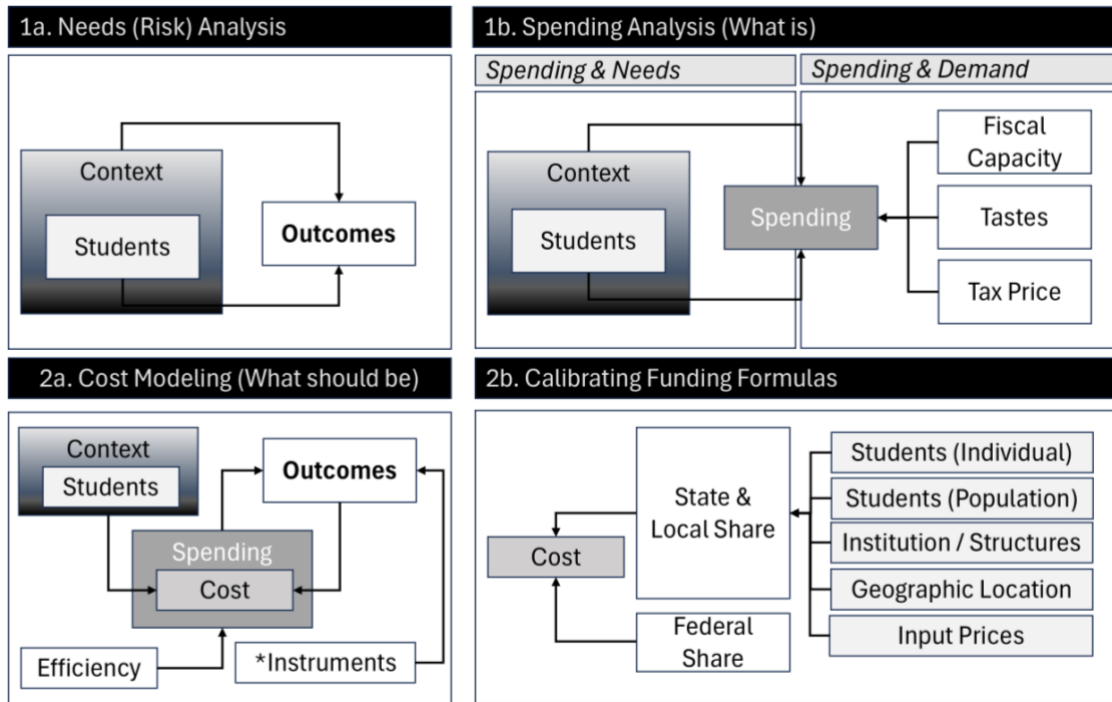
Figure 1 provides a road map to the empirical framework which flows from the conceptual framework. The goal of a school finance system is to deliver the funding necessary for each district and school to provide children with the educational programs and services needed to achieve common outcome goals. It starts with outcomes. Setting outcome goals and standards for all children. Educational equity is achieved when all children have equal opportunity to achieve common outcome goals. Educational adequacy is achieved when those outcome goals are sufficient for those children to become productive, self-determined and civically engaged adults. Combining the two, the goal is to provide all children with equal opportunity to achieve adequate outcomes.

In most state school systems, and across states nationally, existing outcomes vary widely. They vary widely as a function of vast differences in student backgrounds, the environments in which children are raised and the settings in which they are schooled. And they continue to vary widely due to the failures of states to mitigate those variations. Some of these factors are within the control of public policy and schools and others less so. The goal is to identify those factors that



impede progress on outcomes, correct those factors directly within our control and target resources to mitigate the adverse effects of those factors outside of our control. Public health and public education operate similarly in this regard. Health equity is achieved when, regardless of individual backgrounds or environmental conditions, individuals have equal opportunity to live a healthy life, reducing and equalizing risks of mortality and chronic ailments that limit quality of life (Peterson et al., 2001). We can attempt to identify “risk” factors on the front end, and mitigate their effects by providing support and interventions to improve community health and wellness or we can pay the higher price on the back end with more expensive treatments and interventions when the risk factors lead to poor health outcomes.

Figure 1. Empirical Approach to Education Finance Analysis & Reform



## **1a. Needs Analysis**

The first step in the process is to identify those “risk” factors, or what we more commonly refer to in education finance policy analysis as “need” factors. State school finance systems often include additional funding for three such factors – children from low-income households, children for whom English is a second language (perceived as a risk because other content delivery is primarily in English), and children with one or more disabilities. Indeed, children in each of these categories tend to perform less well on commonly measured education outcomes (standardized tests, graduation rates, dropout rates). Rarely, however, is the funding that is currently attached to these categories calibrated toward equalizing outcomes.

We could simply take measures that have typically been used and apply them in the analyses (essentially skipping the first step in Figure 1). But, each of these constructs: 1) economic disadvantage; 2) language proficiency; and 3) disability status, can be measured in different ways, with varied degrees of precision and accuracy, and there may be additional measures above and beyond these (homelessness, foster care) that capture needs above and beyond those commonly used in policy. That said, the capacity to explore possibilities under Step 1a depends on the availability of measures at the level of granularity needed (school or district). The goal in Step 1a is to identify the constructs to be addressed – the factors that most adversely affect children’s educational outcomes – and the measures of those constructs that reveal the strongest relationship to those outcomes. That is, those measures that have the strongest predictive validity with respect to student outcomes. This first step, and those that follow (under 1a and 1b) use

relatively simple regression models, as descriptive tools to identify and illustrate the patterns of relationships in the data.<sup>3</sup>

$$\mathbf{Outcomes}_{sd} = f(\mathbf{Needs}_{sd} \times \mathbf{Context}_{sd})$$

That is, outcomes at the school (s) level within districts (d) are determined both by need characteristics of the student population and by the context in which students are schooled, and the interaction between the two. Economic disadvantage, for example, might be measured at the school level by shares of children qualified for free (130% family income threshold for poverty, where 100% is poverty income) or reduced priced lunch (185% threshold) under the National School Lunch Program, or at the school district level using the child poverty rate (100% income threshold) for families of children between the ages of 5 and 17 who live in the geographic school district and attend public school.<sup>4</sup> Economic disadvantage can also be measured by the income to poverty ratio of families living in the neighborhoods surrounding individual schools (though that may not track precisely with the income of families of children attending those specific schools).<sup>5</sup> Language proficiency might be measured either as a single category of limited English language proficiency or by levels of attainment of on proficiency standards (WIDA).<sup>6</sup> So too can disability status of students in schools or districts be measured at various degrees of granularity. Constraints that guide our selection of measures are that:

- The data must be available, consistently measured, for multiple (5 or more) years;

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<sup>3</sup> It's also important to understand that regression models here are being used as a descriptive tool with universe data (not a sample, but all actual schools and districts). The goal is simply to describe the variance explained in student outcomes, by each need factor, along with understanding the magnitude of the relationship.

<sup>4</sup> For documentation and data access see: <https://www.census.gov/programs-surveys/saipe/data/datasets.html>

<sup>5</sup> For documentation and data access see: <https://nces.ed.gov/programs/edge/Economic/NeighborhoodPoverty>

<sup>6</sup> For information, see: <https://wida.wisc.edu/>

- The data must be uniformly & consistently reported (through a centralized vetted/audited collection/source) across all entities or institutions in the analyses, ideally at the school level but at the very least, at the district level;
- The data must have the potential to be used in translation to school finance policy/formula (the latter steps), which often requires that data can be made publicly available, for full transparency.

Equally important, and the starting point for this entire process is the selection of outcome measures and setting of outcome standards. When we speak of identifying “risk” or “need” factors, we must ask, at risk of what? In need for what, or toward what end? Ideally, we’d be able to measure the larger societal contributions - economic success and civic engagement - of those who pass through our public education systems, just as we’d like to address directly life expectancy and quality of life in health policy. In each case, there are many intervening factors affecting those longer-term outcomes, beyond and outside of our education and health systems. But, in each case, we can identify intermediate, shorter-term measures that serve as reasonable predictors, or indicators, of those longer-term goals. In education, those who perform better on assessments of academic achievement, those who graduate high school, those with better attendance (leading to increased likelihood of success on the other two), tend to have higher educational attainment and more economic success in the years that follow. Again, we are constrained (by first two of the three points above) in our data use and selection.<sup>7</sup> The goal in Step 1a is to construct a comprehensive measure of the desired outcomes and to evaluate which measures of risk or need most strongly affect, or predict variation in that outcome measure. The

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<sup>7</sup> The third constraint – potential for direct use in funding formula calculations – does not apply because the outcomes are used only for determining what factors should be used as such, and not directly included themselves.

measures of risk or need with the strongest predictive validity in step 1a are those that should be carried over into subsequent steps.

### **1b. Spending Analysis: Spending & Needs (What is)**

This leads us to Step 1b. To the extent that certain factors adversely affect the outcomes of interest, more resources – more intensive programs and services – are needed to mitigate the risk posed by those factors. The left-hand side of Step 1b evaluates the current distributions of funding across schools (s) and districts (d) with respect to those needs – or “what is.” That is, if shares of children from economically disadvantaged backgrounds are strongly negatively associated with outcomes, we should see at least some targeting of funding to schools serving more children from economically disadvantaged backgrounds. Of course, the strength of the negative effect on student outcomes might, in part, be a function of the fact that more funding is not targeted accordingly. The purposes of Step 1b is to ask this question and identify existing patterns, using regression models as a descriptive tool, where:

$$\mathbf{Spending}_{sd} = f(\mathbf{Needs}_{sd}, \mathbf{Context}_{sd})$$

That is, spending at the school (s) and/or district (d) level in relation to both student need and contextual factors should presumably be related to spending variation, with a priori expectations regarding the direction of that relationship. Again, I recommend a simple regression approach as a descriptive tool to characterize the relationships between each need factor, and spending variation, in the context of other factors such as economies of scale, grade ranges served and so on. This approach can reasonably be applied at the district (d) and/or school level (s), and should be similarly applied at both in order to contextualize school expenditure variation within district expenditure variation. While we typically start by looking at each need factor with respect to

outcomes individually, it is important that we understand how poverty measures relate to outcomes, while controlling for other factors such as shares of children with disabilities. Other approaches comparing (by calculating population specific weighted averages) the average funding per child from a low income versus non-low-income family are not useful in this regard and often yield misleading findings.

A school funding system where funding is higher in schools or districts with greater needs would be considered *progressive* and one where funding is lower in schools or districts with greater needs would be considered *regressive*. This step does not, however, inform us regarding how much more funding would be required to mitigate the adverse effects of each “need” factor on outcomes. That is, how progressive is progressive enough to provide equal opportunity? That comes later when we use cost models to estimate “what should be.”

### **1b. Spending Analysis: Fiscal Neutrality & Demand (What is)**

Step 1b also includes a more traditional school finance *fiscal neutrality* analysis. That is, to what extent do the spending choices and characteristics of local communities – public school districts – drive school and district spending differences, regardless of need. Literature on local public finance suggests that the demand for local public goods and services – measured by choices on how much to spend on public goods and services – is influenced by the income and preferences of the median voter and the price in taxes paid to raise an additional \$1 of revenue (Holcombe, 1980; Gramlich & Rubinfeld, 1982; Corcoran, Evans & Schwab, 2010). Communities with higher income families may choose to spend more, because they can. Communities with larger shares of adults and parents with higher education may have greater preference to spend on schools. Communities with larger shares of elderly citizens without school aged children may have less preference to spend on schools (Fletcher & Kenny, 2008). And communities where

larger shares of the taxable property wealth lie in high value commercial or industrial properties may have an easier time raising that additional \$1 in revenue (because less of it falls on the median voter/homeowner). A well-designed state school finance formula should mitigate these inequities – leading to spending differences across schools and districts that are *neutral to* (or uncorrelated with) wealth and income. If children’s education rights are guaranteed in state constitutions, access to those rights should not be determined by local wealth, income or preferences of local voters. Again, using a descriptive regression model:

$$\text{Spending (or Revenue)}_d = f(\text{Income}_d, \text{Tax Price}_d, \text{Tastes}_d)$$

That is, per the classic median voter model, spending or revenue at the district level is a function of income, tax prices, local voter tastes, with consideration for the role of intergovernmental aid. The right-hand side of Step 1b serves a secondary purpose for us (when estimating cost models) in identifying factors that may predict spending variation that is not associated with outcomes – or *inefficiencies*, per se. This should not necessarily be construed as *waste*. Rather, some communities with high income and low tax prices may choose to spend on additional programs and services (more elaborate arts programs, electives, boutique sports like fencing, lacrosse, squash, etc.) that the community desires but may have less direct impact on the outcome measures used in our models. Because this method draws on public finance theories (and measures) applicable to local governments – or the fiscal stewards of public schooling that have taxing and budget authority – these models can only reasonably be applied at the district level. This brings us to Step 2.

## 2a. Cost Modeling (What should be)

Step 2 takes us from characterizing “what is” to estimating a model of “what should be.” That is, cost modeling to determine the spending associated with achieving the desired outcomes for all children and across all settings. The dependent measure being modeled is spending on schools (and the children attending) which includes spending variation associated with the outcomes in question (cost) and spending variation on other community preferences and institutional choices. The goal is to determine the spending associated with achieving the desired outcomes, across all settings and children. So, in the upper left of 2a, I include the need or risk factors and other district characteristics like economies of scale, population sparsity, regional variation in competitive wages. These are “cost factors” in that they are a) factors outside the control of local schools or districts, that b) affect the spending needed to achieve the desired outcomes (cost).

In the lower left (purple) I include factors that might affect spending choices not directly associated with the measured outcomes, noting that the measured outcomes do not always, or often represent the full scope of what we expect from public schooling. When making predictions of “costs” for each district, we set factors in the lower left to the state average to generate predictions of spending associated with achieving the desired outcomes, for districts of average wealth, income, tastes and tax prices, as well as additional efficiency pressures (predictors of the average mix of “other” spending). As a general model:

$$\text{Spending}_{sd} = f(\text{Outcomes}_{sd}, \text{Student Needs}_{sd}, \text{Context}_{sd}, \text{Input Prices}_r, \text{Inefficiency}_d)$$

One can estimate this model either or both at the school (s) and district (d) level, but being cognizant that school budgets, teacher salaries and student assignment across schools within



districts as well as factors influencing taxation, state aid and revenue sources are determined at the district level. An additional complexity in cost modeling, where spending per student is the dependent measure (the thing we are predicting) is that spending and outcomes are simultaneously determined, or exist in somewhat of a circular relationship in this complex social system. Spending affects the outcomes, but outcome goals affect the spending choices. Researchers often attempt to evaluate how spending affects outcomes, given other intervening factors similar to ours here, in an education *production function* (Baker & Knight, 2024).

One might ask, why not use such an approach here to determine how much more we'd have to increase spending to increase outcomes accordingly? While that approach seems logical, it misses one critical feature of the cost model – the importance of sorting out that portion of spending variation associated with outcome variation versus the portion driven by demand preferences and other possible determinants of *inefficiency*, including competition density and local public monitoring (Duncombe, Miner & Ruggiero, 1997; Grosskopf, Hayes & Taylor, 2014). We can only address (and control for) that variation in our cost predictions by putting the spending measure as the dependent measure and including indirect predictors of *inefficiency* among our independent variables. When we put spending as the dependent measure and outcomes as an independent measure, we must treat outcomes as “endogenous,” using what is called an instrumental variables or two-stage least squares procedure to correct for bias in the outcome measure. I follow the now standard statistical guidance across peer reviewed literature and authors over the decades (Duncombe & Yinger, 2006, 1998, 1997; Gronberg, Jansen & Taylor, 2017; Taylor et al., 2018; Imazeki & Reschovsky, 2006; Zhao, 2022).

## 2b. Translation to Policy: Weights Modeling & Formula Calibration

My colleagues and I have learned through the process of consulting with numerous U.S. states, using cost models to inform recalibration or overhaul of state school finance formulas that it is important that we translate the often-complex cost model into relevant, useable policy alternatives. Hence, step 2b. As noted above, the cost function is a complex model that identifies the statistical relationship between spending and outcomes (at average efficiency) and can be used to predict the spending needed to achieve any given level of outcomes (at average efficiency) for each school or district in a state (or nationally) based on the children they serve and their geographic and economic context. It is possible to take the per pupil cost predictions generated by the cost model, and approximate those cost predictions with a weighted foundation aid formula. Student population and district characteristics used in weights models should be as simple as plausible, while approximating as closely as possible, cost targets. Measures used in policy – written into state (or federal) finance formulas – should be a) publicly available via audited government sources, b) annually updated, and c) explain the vast majority of cost variation identified in the cost model.<sup>8</sup>

The cost predictions from the previous step include spending of revenues from state and local sources and from federal sources. So, often in this step, because we are focused on the state and local funding needed, we start by subtracting the *usual* (in non-emergency, e.g., pre-COVID times) rates of federal contribution from the cost targets. Next, we identify a set of measures,

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<sup>8</sup> See Levin et al. 2022, who explain:

- The measures must be consistently and regularly collected on at least a biennial basis to allow for alignment with the frequency with which community college funding is determined in Texas.
- The measures must be publicly available, such that the formula built upon them is transparent and replicable.
- The measures must be understandable to policymakers.
- The measures must predict the vast majority of the explained variation in the dependent variable used in the education cost function model (spending).

perhaps those used in the current funding formula if that formula contains the “right” factors, that may be used to approximate, or predict, our cost model estimates (with federal aid removed). This process involves estimating what we call a “weights” model which helps us determine what weight (or multiplier) would need to be applied to current (or common) factors, and with what base level of funding in order to fund equal opportunity for all children. That is, to hit our cost targets from the cost model. We can take the weights and base funding from our weights models and construct a funding model applying those weights (and base) to each district to generate their adjusted foundation (state and local) funding targets, and we can calculate the equitable state and local shares each district would be required to contribute toward their respective adjusted foundation targets.

$$(\text{Cost}_d - \text{Federal Contribution}_d) = f(\text{Needs}_d, \text{Context}_d, \text{Input Prices})$$

Alternatively, we can, as we have recently, estimate a national model and craft a new formula for allocating federal aid across schools and districts to provide equal educational opportunity nationwide (Baker, Di Carlo & Weber, 2023).

### **Insights from Recent Applications**

Education cost modeling has been used for decades in elementary and secondary school finance in the United States, most often applied in specific state contexts. For example, in the 1990s and early 2000s, authors Andrew Reschovsky and Jennifer Imazeki applied cost function modeling in Texas to evaluate spending gaps, using methods similar to those I propose here (Imazeki & Reschovsky, 2006, 2004). Meanwhile, Lori Taylor, Dennis Jansen and Tim Gronberg of Texas A&M were also estimating cost models on Texas k-12 schools (Gronberg, Jansen & Taylor, 2011). William Duncombe and John Yinger were primarily estimating cost models on New York

State (Duncombe & Yinger, 2000), but also provided cost modeling in 2006 for the state of Kansas to guide court ordered reforms (Duncombe & Yinger, 2006; Duncombe, Lukemeyer & Yinger, 2008). Eleven years later, Lori Taylor provided follow up cost modeling for the state of Kansas (Taylor et al., 2018). Limited applications existed in international contexts and beyond elementary and secondary education. Applications to other public sector services including fire protection also exist (Duncombe & Yinger, 1993).

Our own recent work has involved mostly elementary and secondary education in the United States, including a handful of recent and forthcoming state specific studies (Kolbe et al., 2019; Kolbe et al., 2021; Baker et al., 2020; Atchison et al., 2023), and a national education cost model (Baker, Weber & Srikanth, 2021). More recent applications of that work to postsecondary education – specifically community college systems – has raised new possibilities (Romano & Palmer, 2023). This work has also led us to rethink our applications of cost modeling for elementary and secondary education systems as well as how we might expand this work and apply this framework globally – beyond k-12 schooling in the U.S.

Most early domestic elementary and secondary education models, and our national education cost model have relied on measures of student population characteristics already used in U.S. state school finance formulas. Tables 1 and Table 2 summarize the types of measures my colleagues and I have used in recent work in U.S. elementary and secondary and community college modeling. For outcomes in elementary and secondary education, we have typically used some weighted combination of outcome measures which we refer to as an *Outcome Factor Score*. We construct that index via structural equation modeling to determine the weights to be applied to each component of that index. We find that the Outcome Factor Score, while highly correlated with (because they are a component) of state assessment scores, also differs in

important ways for many schools or districts. In our postsecondary analyses, we have focused on completion (within a specific time frame) measures, and measures of progress toward completion. Completion rate at 150% time, for example, for Community College students would be the share of students who completed a degree or certificate program within 150% of the expected time (3 years, for a 2 year program). Instruments for the outcome measures typically include measures of the competitive context of institutions, such as the outcomes and/or demographic mix of students from surrounding institutions.

When it comes to selecting a spending measure, the goal is to select as comprehensive a measure of annual operating expenditures as possible. That is, the annual spending that contributes most directly to the annual measured student outcomes in our models. Typically, only capital investments are excluded because capital spending in any one year contributes not only to the outcomes of students attending in that year, but also those in future years. Additionally, there exists a lagged response wherein outcome effects of many capital investments may not show up for 3 to 5 years (Baker & Knight, 2025).

Indirect predictors of efficiency fall into three categories in the context of the cost model: 1) fiscal capacity; 2) public monitoring; and 3) competition density. The first two overlap with concepts of demand for local public schooling, as estimated via median voter models. Local taxing jurisdictions with greater taxable wealth (requiring lower tax rate to yield comparable revenue) and greater income from which to pay those taxes will spend more, all else equal, and are likely to spend on additional programs and services not directly related to outcomes included in our index. Communities where more aid is received from other governmental sources (or other taxed properties) may be less likely to put pressure on their local schools to spend less. That is, less engaged in public monitoring. Population age and racial demographics have a complicated

relationship with school spending choices (Oberfield & Baker, 2022). So too does the role of competition. Presumptively, more competition - more geographic school districts operating in a space where home owner voters can choose among jurisdictions for the price in taxes they wish to pay, for the quality of schooling available – should create pressure to improve school quality while holding down taxes. But spatial competition has also been shown to lead to competition to provide better quality by simply outspending neighboring districts (Slagle, 2010).

Table 1. Outcomes, Spending & Efficiency Measures used in Recent & Ongoing Studies

	<b>Outcomes</b>	<b>Instruments</b>	<b>Spending Measures</b>	<b>Efficiency Measures</b>
<b>Elementary &amp; Secondary</b>	<i>Outcome Factor Score (OFS)</i> <sup>[1]</sup> ELA & Math Assessments Absenteeism Cohort Graduation Adv. Diplomas Dropout Rates	<i>Neighbor</i> <sup>[2]</sup> <i>Outcomes</i> Assessments OFS  <i>Neighbor Demographics</i> Income/Poverty Ratio Racial Composition Education Levels (% BA or higher)	Annual Operating Expenditures per Pupil Excluding Debt (principle & interest) & tuition transfers	<i>Fiscal Capacity</i> Relative Income Taxable Wealth <i>Public Monitoring</i> % School Aged % over 65 % intergov aid % Residential Value <i>Competition Density</i> Herfindahl Index Charter/Private Mkt Share
<b>Community College</b>	150% (or 200%) Time Completion  “Success Points” milestones (Texas) <sup>[3]</sup>	% of students in K–12 special education in the county  % k12 students in county from low-income families  Outcome index of k12 students in county (SEDA) <sup>[4]</sup>	Annual Operating Expenditures per Headcount (or FTE) Student  Instructional spending per headcount (or FTE) student	Fiscal Capacity Public Monitoring Competition Density

[1] Weighted factor score generated via structural equation modeling

[2] Neighbors have been defined in a few different ways. At the district level, we’ve used averages of all other districts in the same labor market (or metro area) space. At the school level, we’ve used measures of the nearest X (5 or 10) other schools outside of the observed district.

[3] Texas Higher Education Coordinating Board. See Levin et al. (2022)

[4] Stanford Education Data Archive (<https://edopportunity.org/>)

Student need and context measures we have used and proposed to use in recent analyses are shown in Table 2. There are several important considerations in identifying and selecting student need measures. Most importantly, they should be measures that are outside of the control of the institutions. That is, we do not include measures of low academic outcomes from within the system, but might use low academic outcomes of children from surrounding high schools in a model for Community Colleges. Second and most importantly, the basis for selecting an appropriate measure of risk or need is whether and to what extent that measure is predictive of our outcome index. That is, does the measure in question actually predict a likelihood of lower outcomes? Building on this (predictive validity) as the primary selection basis, we can also evaluate whether adding complexity (and sometimes cost) in either the collection of data or explaining the measure, provides any added predictive validity. If the additional complexity yields no greater predictive validity (of the outcome factor score), then the simpler, less costly measure to collect is the better choice.<sup>9</sup>

A variety of measures of child poverty are available, where one distinction between the measures is whether they measure the income and poverty rates of children from families in the geographic area surrounding schools or district, or whether they are measures of the children in attendance in those specific schools. In areas of significant school choice related mobility, measures based on geographic location rather than school enrollment may not work as well. But we have also found that in some generally low-income areas, measures such as shares of children from families qualified for free or reduced priced lunch under the national school lunch program do not capture sufficient variation across schools or districts, because such large shares of all children fall below

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<sup>9</sup> An alternative approach to evaluating predictive validity, along similar lines, would be to evaluate whether and to what extent prior targeting of additional funding on the basis of X vs. Y yields greater return on investment. For example, Rauscher and colleagues (2024) find significant returns to spending on districts in counties with high rates of children with low birthweight, suggesting that low birthweight may be a reasonable need variable to include here.

these income thresholds. Again, the goal is to identify the measures that best capture risk of adverse outcomes. To do so, we have, in some cases relied on indices that combine multiple measures, or use regression models to generate a predicted student need index.

Our postsecondary work has led us to different measures related to our outcomes of interest – persistence and timely completion. Shares of students receiving Pell grants may serve as a proxy for shares from low-income families or who themselves are low income. Shares of students who are the first generation in their family to attend college and shares who are over certain age thresholds may also be at risk of non-persistence or non-completion.

Institutions choose to spend more on some programs and program types than others, whether it truly costs more to achieve common outcomes in those programs. Yet, it remains important to capture some of these differences in our models, including grade range distributions in k-12 systems or program offering enrollment distributions in post-secondary systems. We have found in k-12 analyses, especially at the school level and especially in the presence of large numbers of charter schools, simple grade level dummy variables (elementary, middle, secondary) are insufficient. It is better to use measures of the shares of enrollments in certain grade ranges. We have found it important in our postsecondary analyses to include shares of students in science and technical programs which appear more costly to operate and sometimes also have lower completion rates.

Finally, we adopt a handful of approaches to capture regional differences in competitive wages, typically using the Comparable Wage Index for Teachers in our k-12 work, and sometimes using measures of faculty wages in surrounding institutions in our postsecondary work.



Table 2. Student Need and Context Measures Used in Recent & Ongoing Studies

	Student Needs		Context		
	<i>Individual</i>	<i>Collective</i>	<i>Institutional / Structural</i>	<i>Geographic Location</i>	<i>Input Prices</i>
<b>Elementary &amp; Secondary</b>	<i>English Learners</i> By WIDA <sup>[1]</sup> <i>Disability</i> By Severity <sup>[2]</sup>	<i>Child Poverty</i> <sup>[3]</sup> SAIPE NSLP (FRL) Direct Cert Predicted Index IPR  <i>Racial Isolation</i> <sup>[5]</sup>  Homelessness Migrant Students	<i>Grade Range Distributions</i> % in 6 to 8 % in 9 to 12  <i>Institution Size/Scale</i> Enrollment groups (up to 2,000)	Population (or enrollment) Sparsity	Regional Comparable Wage Index for Teachers <sup>[4]</sup>
<b>Community College</b>	% PELL % First Generation Household Income % >24 years of age % English Learners		Program Enrollments % Sci/Technical % Dual-Credit	Institution Size (enrollment) Categories  Population Density	Regional Comparable Wage Index  Regional Faculty Wage Index

[1] WIDA refers to the Access for ELLS standards which identify language proficiency at multiple levels and have been adopted by several states. Data reporting remains too sparse for use, as of yet, in our models (<https://wida.wisc.edu/assess/access>)

[2] LD/BD/OHI vs. Other

[3] Residential location measures include Census Small Area Income and Poverty Estimates (SAIPE) <https://www.census.gov/programs-surveys/saie/data/datasets.html> & the Neighborhood Poverty Index, or Income to Poverty Ratio <https://nces.ed.gov/programs/edge/Economic/NeighborhoodPoverty>.

[4] Comparable Wage Index for Teachers <https://nces.ed.gov/programs/edge/Economic/TeacherWage>

[5] see Baker, 2024

One other important consideration involves the level of precision at which the system should be modeled, or smallest unit of analysis in our model. Until recently, largely due to insufficiency of panels of school level spending data, k-12 cost modeling was conducted exclusively at the district level. There are reasons why this remains the more logical choice, most notably that budgets are set, aid allocated and spending determined at the local district level – not the school level. The case would be similar in community college systems governed and financed at the county level. Measures related to efficiency, capacity, etc. can theoretically only be captured at

the local education agency or taxing jurisdiction level (community college districts, or specifically taxing districts). Additionally, in k-12 systems, student assignments to schools, either by establishing attendance zones or by providing specific programs in specific schools, are controlled by districts. That is, district officials control the student related cost variation across schools within districts (where in the district, children are served), but do not control their aggregate student need related costs (e.g., who the district must serve).

Eventually, to inform state level funding policies, where state aid is delivered to local districts, school or institution level models must be rolled up to district level costs. That said, information from school level models may be used to guide district allocations to schools and inform district officials of the cost implications and efficiency considerations of their student assignment and program delivery policies. In states with large city school systems, and substantial heterogeneity within, school level models can provide important additional insights affecting large shares of children (about 36% of New York State school children attend school within New York City).

Applications to post-secondary systems such as state community college systems differ in this last step, but are still based on the goal of adjusting institutional aid to provide equal opportunity for student success – most commonly measured as on time completion. States might use weights either to adjust direct aid to community colleges to provide greater support for student success, or, as in Texas, adjust weights on performance-based funding factors based on estimates of student needs and costs to succeed on specific outcome metrics.

We have also found results of state specific elementary and secondary cost models to be increasingly consistent, yielding cost predictions highly correlated (.8 and higher) with our national education cost model, where state specific models often use entirely different data

sources and are estimated at the school level, then rolled up to district level costs for comparison with the national model (Baker, 2024).

## **Goals and Next Steps**

My goal herein is to provide a general, flexible, commonly accepted and consistently applied framework for evaluating and improving school finance systems, whether for elementary and secondary education in the U.S., postsecondary education in the U.S., or other systems globally. This starts with acknowledging that the goal of these funding systems and models is to provide all eligible participants (children or adults) equal opportunity to achieve the outcomes of interest – which starts with conversation to determine those outcomes of interest. This framing determines all that flows from it, conceptually and empirically. It determines our concepts and measures of costs and needs (which are also costs). Costs and cost differentials necessarily refer to the costs associated with achieving common outcomes (Duncombe & Yinger, 2012).

The reason we seek measures of child poverty or economic disadvantage isn't to find the most exact income cut-point or classification scheme for defining some construct of "poverty" in isolation. Rather, the goal is to identify measures of conditions that explain or predict educational disadvantages, and more importantly measures that might be useful for targeting resources to mitigate those disadvantages.

Jumping to the policy side of the framework, what we weight, and how much we weight it in a funding formula should be determined accordingly – that we weight those factors which pose risks of lower outcomes, and we weight them (apply additional resources) sufficiently to mitigate

those risks, using methods designed to estimate the appropriate magnitudes.<sup>10</sup> A “cost” factor, per se, is a factor that affects the costs of achieving a common outcome or set of outcomes. A weight is “cost-based” if a) it is applied to a factor or measure that affects the amount that must be spent to achieve the outcome goal(s) in question, and b) it is calibrated in magnitude using rigorous methods to determine the additional spending needed to achieve the outcome goal(s) in question. A formula for funding educational institutions is only “cost-based” if it is built on factors that are cost based. More broadly, a formula for funding educational institutions can only adequately support children’s rights to achieve common educational outcomes if that formula is calibrated accordingly.

One criticism of this approach is that it is *deficit-oriented*. I do not deny that the approach focuses on inequality of educational outcomes, where one’s lower outcomes are, in relative terms in deficit when compared to another’s higher outcomes. I do not believe that children’s backgrounds or where they reside should predict who has the lower or higher outcomes. And the intermediate outcome measures selected to guide the analyses affect longer term life goals. It is what it is. Concerns over the deficit orientation are why my colleagues and I shifted from referring to “risk” factors as “need” factors. Asthma, obesity and diabetes are all certainly risk factors in a public health context. In fact, all three are also poverty-associated risk factors in an education context, to the extent that they are highly predictive of chronic absence (Baker, 2014). Our goal is to leverage school finance policies as a tool for mitigating risks, and achieve more equitable outcomes for all children (and adults). Failing to address the predictors of outcome inequality means leaving in place the conditions and structural inequalities that continue to

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<sup>10</sup> We argue that it’s also important that we, or others not bypass Step 1 and jump straight to Step 2. It’s important that we carefully evaluate which measures – and versions of them – best capture risk and need before using them to determine costs.

produce outcome inequality. I address in related work, major structural changes focused on racial and economic integration, and *integrative defragmentation* of local public school districts in the U.S. as we know them, to reduce the need for targeted funding (Di Carlo & Baker, in press).<sup>11</sup>

Our collective, ongoing and future explorations involve:

- More thoroughly expressing the outcomes that children should have equal opportunity to access/achieve;
- More comprehensively capturing those factors outside of institutional control that affect children’s likelihood of success;<sup>12</sup>
- Better understanding institutional spending choices, programs and services being provided that do not contribute directly or as much to the outcomes we are able to measure (the “inefficiency” problem).

Finally, we are interested in reconciling findings of these analyses, which largely focus on cross sectional variation in spending, outcomes and contexts with longitudinal causal models estimating the return to educational outcomes of spending changes and most notably the variations in return by student needs and school contexts (see Baker & Knight, 2024).

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<sup>11</sup> We also believe in a need for rethinking the role and value of language diversity in U.S. schooling contexts as relates to the goals of public schooling and how we measure outcomes toward meeting goals. Indeed, most instruction is provided in English, such that lacking fluency in English results in lower outcomes on assessments across subject areas, when assessed in English. Such are the structural constraints that currently inform our models. But on this point, at least, there may be future opportunities to view and measure multilingualism and language diversity differently. See Grapin (2024a, 2024b) Individual race and racial composition of schools also should not be considered a deficit, per se. Racial diversity, like language diversity is advantageous for all. Rather, we acknowledge that corrective, in some cases reparatory actions are required to mitigate and correct the effects of past and present systemic, policy induced racial inequality, including racial isolation (See Baker, 2024).

<sup>12</sup> For example, Rauscher & Shen (2022) evaluates the influence of investment in schooling with respect to county level low birthweight rates, finding very high rate of return to investment when funding is progressively targeted to school districts in counties with high rates of low birthweight.

We have come a long way over the decades in refining both our conceptual understandings of the goals and design of school finance systems and in data accessibility and empirical methods for evaluating those systems. High courts in some U.S. states have adopted children's rights conceptions fully aligned with the framework we propose herein (Baker, 2022). Whether judicially mandated or not, we owe it to our children to provide more equal opportunity, through public education systems, public health systems, and beyond, to live fruitful, productive, healthy lives, to be informed and civically engaged. State legislatures and governors control whether that happens in pre-k through postsecondary education in U.S. States and U.S. Congress can provide for greater inter-state equality of educational opportunities. Similarly, national and provincial governments in other nations may wish to more equitably and adequately finance their education systems and global aid organizations may have interest in more empirically rigorous bases for understanding the costs of improving education systems in developing nations. But the first step is to adopt a common, consistent, coherent framework for understanding the nature of the problem and sound empirical metrics for evaluating the magnitude of the problem and costs of solving it.

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