Wage adjustments in state school finance policy: Do they improve or erode school funding equity?

Bruce D. Baker
Associate Professor
University of Kansas
bbaker@alumni.lafayette.edu

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1.0 Introduction

The goal of this study is to evaluate the implementation in state school finance formulas of adjustments for the costs associated with recruiting and retaining teachers. Cost adjustments in state school finance policy are inherently political tools, driving resources toward some districts and constituents and away from others. Cost adjustment systems in state school finance formulas can, in some cases, lead to systematic allocation of greater resources to school districts having lower actual costs, when evaluated using reasonable empirical methods (Baker and Green, 2005). The balance of winners and losers under cost adjusted state school finance formulas is as likely to represent the political balance of power in a state as it is likely to represent actual costs and needs (Baker and Duncombe, 2004).

Adjustments for teacher wages can be particularly problematic, in part, because it can be too easily argued that more affluent areas within a state require higher wages either to compete with high wage workers in the same affluent area, or to purchase housing or other goods purchased by those high wage workers in that area (Baker, in press). But subsidizing wealthy school districts to support higher teacher wages may significantly erode rather than advance equity, when many wealthy districts share a labor-market with poorer urban and urban fringe districts. It is increasingly well understood in teacher labor market literature that even at comparable wages, teachers are more likely to pursue careers in districts with more desirable working conditions (Ondrich, Pas and Yinger, 2007). Further, the unequal distribution of student population characteristics and teaching quality explains a substantial portion of the increase in achievement gaps between grades 3 and 8 (Hanushek and Kain, 2007).

In recent years, there has been a flurry of activity regarding the redesign and revision of state school finance formulas, and adoption of new adjustments to address teacher wage variation. In this article we evaluate wage adjustments in six states – Colorado, Florida, Missouri, New Jersey, New York and Texas. Of these states, policies have been in place for some time in Texas, Colorado and Florida. Missouri, New York and New Jersey are each in the process of adopting new statewide funding formulas to include new or updated wage indices. We begin this article with a review of approaches to wage adjustments for school finance. Next, in Section 3, we review the design of indices produced by the National Center for Education Statistics, including their 1993-94 Geographic Cost of Education Index and the more recent 2004 Comparable Wage Index.

In Section 4.0, we summarize the design and implementation of the wage indices in the six states. Finally, in section 5.0 we evaluate the indices in an attempt to discern whether, on average, the indices are doing more harm than good. That is, are the indices as they are implemented in state school finance policies advancing equity or eroding it? We decompose this question into three parts:

1) Are the state adopted wage indices correlated across districts within states with either or both NCES indices?
2) Are the state adopted wage indices correlated across districts within states with poverty rates and/or housing values?
3) When switching out the state adopted indices with NCES indices, do equity measures (Gini coefficient and Theil Coefficient) improve or worsen?

Holding NCES indices as a standard for *getting it right*, the first analysis asks whether, on average, districts identified as having higher labor costs under each NCES index were also

identified as having higher labor costs under the state adopted index. In the second question, we explore the possibility that the wage index might drive resources away from higher poverty districts, in conflict with equity goals, and we explore the possibility that the adopted index may be too heavily influenced by local housing values. That is, the index simply subsidizes the rich. For this analysis, we compare the correlations between the adopted index and poverty and housing values, and between NCES indices and poverty and housing values. If, for example, both NCES indices are positively associated with poverty – higher poverty rate, higher index – but the state adopted index is negatively associated with poverty, the state adopted index might be problematic.

Finally, in our third question, we test a series of *what if,* scenarios replacing state adopted indices with the NCES indices in funding formula simulations. Then, we estimate cost adjusted equity measures under each scenario, using as cost adjustments, the alternate NCES indices. In short, our goal is to discern whether the least or most equitable option for each state is its currently adopted wage index. That is, would equity be improved by adopting either NCES index?

2.0 Perspectives on Wage Variation

Historically, three basic approaches have been used to address differences in competitive wages for teachers across school districts or broader regions within states. The three basic approaches to adjustments include (a) cost of living adjustments, (b) comparable wage adjustments and (c) hedonic wage model adjustments.[1]

Cost of living adjustments are intended to compensate teachers and other school employees across school districts or regions within a state for differences in costs of maintaining

[1] For a more complete review with analysis of pros and cons of each method, See Duncombe and Goldhaber (2004)

comparable quality of living. Cost of living adjustments typically assume some basket of basic goods and services required for attaining a specific quality of living. Goods and services of a specific quality level are identified, and the price differences for purchasing those goods or services are estimated across regions in a state. The basket of goods typically includes things such as housing, food, clothing, childcare and healthcare.

While cost of living adjustments may seem appealing at a very cursory level, it is often the case that wealthy, generally more advantaged school districts in and around more desirable locations will show higher costs of the basket of goods and services. Using an index based on such findings results in supporting very different rather than similar quality of life across teachers within a state. One might imagine an extreme case where a cost of living adjustment considers only housing prices and where there are two school districts – one with palatial estates and another, a neighboring slum of decaying multifamily housing units. Funding schools or paying teachers on the basis of the differences in housing unit values, such that the teachers in the affluent district can afford palatial estates and the teachers in the slum can afford to live in the slum clearly supports a different, not similar quality of life.

Competitive (Comparable) wage adjustments are estimated for teachers by evaluating regional variations in wages among non-teachers. To the extent that competitive wages for non-teachers in specific occupations and industries (at similar levels of experience, education, age, etc.) vary across regions or school districts within a state, so too, it is assumed, that competitive wages for teachers must vary. Because local labor markets vary, competitive teacher wages must vary.[2] If, after controlling for degree levels and age, occupation and industry, non-teachers on average earn 10% more in Region A than in Region B, so too it is assumed that teachers should be paid a higher wage in Region A than Region B. It is assumed that the 10% differential reflects

[2] For a more thorough discussion of Comparable Wage Indices, See Taylor (2005)

a legitimate labor cost differential between the two regions, including among other things, differences in the cost of living for otherwise similar workers, as well as preferences to live and work in one location versus another at any given wage.

A related assumption is that the relative competitive wage of teachers should be similar across regions within state, reducing the likelihood that in some markets more than others, teachers will migrate to non-teaching professions. However, little is known about the mobility of teachers into other supposedly comparable or competitive professions and vice versa, and less is known about the potential role of wages in influencing mobility into and out of the teaching profession from other professions. Podgursky, Monroe & Watson (2004) note: "Examination of non-teaching earnings for exiting teachers finds little evidence that high-ability teachers are leaving for higher pay." (p. 507)

Hedonic wage adjustments focus specifically on teachers' employment choices within the field of education and attempt most directly to provide each school district with comparable opportunity to recruit and retain teachers of similar quality. A vast body of educational research indicates that teachers' job choices are driven primarily by location and work conditions including but not limited to student population characteristics. Neither cost of living indices nor competitive wage indices addresses work conditions of teachers. Among those work conditions that are typically considered outside of the control of local school administrators are student population characteristics, crime and safety issues and to some extent facilities quality and age. A well estimated hedonic wage index should capture the negative effects of difficult work conditions on teacher choices, resulting in higher index values for the cost of recruiting a teacher of comparable quality into more difficult working conditions, assuming all else equal. This is easier said than done. Other factors beyond the control of local school administrators may

include the remoteness of a school district and access to local amenities. Hedonic wage indices also include consideration of cost of living factors. Where cost of living adjustments alone may simply serve to support a better quality of life (rather than similar quality of life) for teachers in more affluent school districts, a hedonic approach can counter some of this effect with work condition and location factors that often contrast with cost of living measures.

Shortcomings of the hedonic approach most often relate to the availability of sufficient, detailed data to capture expected patterns of competitive wage variation in relation to teacher quality. Presently, teacher wages vary both within and across school districts primarily as a function of years of service and degree level, due to the single salary schedule used in nearly every public school district. Yet, there is little evidence that either years of service or degree level (as typically compensated in the single salary schedule) alone are good measures of teacher quality. In most cases, the best one can do in estimating a hedonic wage model is to control for these two major factors and then discern the extent that work condition factors and costs of living influence the differences in wages across districts for teachers at similar experience and degree levels. Ideally, available data would include measures of teachers own test scores and/or the selectivity of the undergraduate institutions attended by teachers – two "teacher quality" factors more frequently associated with improved student outcomes. Even when better teacher quality measures are available, if few or no teachers with strong academic backgrounds work in schools with adverse working conditions it can be difficult to estimate what it would take to get them there.

Applications to School Finance Policy

Among the three approaches, hedonic wage indices are most appropriate for use at the district level where it may be of significant importance to provide districts having the most difficult working conditions locally with the necessary competitive wage to attract teachers of at least minimum desired quality. That is, indices based on hedonic wage models can and should be used to influence within-labor-market, cross-district sorting of teachers, where labor markets might be defined as metropolitan areas or other within-state regions more highly aggregated than individual districts, cities or towns.

Other wage indices, like competitive wage and cost of living indices are problematic when applied to individual districts because they are more likely to have the effect of providing recruitment and retention advantages to those districts already advantaged within labor markets (wealthier suburbs over neighboring poor urban districts in the same metropolitan area). That is, at the micro level, between two neighboring districts in the same region of a state, it would likely be found that housing and other costs are higher or competitive wages higher in the more affluent of the neighboring districts. It would be inappropriate from an equity perspective to provide additional incentives to attract teachers to the more advantaged district in the same labor market as other disadvantaged districts. Indeed, poorly estimated hedonic indices that fail to capture additional costs of difficult working conditions suffer the same problem, though usually to a lesser extent.

Instead of district level indices, comparable wage or cost of living indices might be applied to the consolidated metropolitan statistical area (CMSA), or core based statistical area (CBSA) covering a wide array of districts of varied need, but neither compensating for, nor against those needs. The downside of even this approach is that districts in economically depressed regions of a state will likely be assigned lower competitive wage or cost of living

indices, making it difficult to ever recruit in new, higher quality teachers from other regions of the state. In effect, the index will reinforce the depressed condition of the local economy.

Summary of Pros and Cons

Table 1 summarizes the three approaches, their application, strengths and shortcomings. First and foremost it is important to differentiate between the goals of the methods. The only of the three methods that attempts to capture the complete context of non-pecuniary factors that may influence a teacher's choice to work in one district versus another is the Hedonic Wage approach. Among the three, Cost of Living approaches are most problematic, primarily because they most often lead to supporting higher quality of living for teachers in advantaged school districts, serving more advantaged student populations. Cost of Living approaches are even more problematic when applied to districts rather than broader labor markets as a unit of analysis, because they provide incentives for teachers in disadvantaged districts to take better jobs at a higher wage in neighboring more advantaged districts.

Competitive Wage indices can be a significant improvement over cost of living indices, but the relationship between private sector wages and teacher wages remains tenuous and poorly understood. Further, financing schools on the basis of private sector wages may, in part, lead to reinforcing economic disparities across a state. Indeed the same is partly true of hedonic wage models which, lacking sufficient teacher quality measures, may indicate the necessity for lower wages in school districts with lower housing costs, and generally lower private and public sector wages.

Table 1
Summary of Wage Indexing Methods

Approach	Goal	Data	Geographic Unit	Strengths	Shortcomings
Cost of Living	Address uncontrollable costs to employees of living in commutable distance to work (comparable quality of life for teachers)	Basket of local goods/ services in area of commutable distance	Labor market (CBSA/ CMSA)	Less influenced by current teacher compensation	Most often supports higher quality of living for teachers in "advantaged" districts
Competitive Wage	Provide wage required to keep a person with specific education/ knowledge/ skills in teaching within a specific labor market	Wages of non-teachers (based on place of work)	Labor market (CBSA/ CMSA)	Less influenced by current teacher compensation Based on competitive labor market assumptions	Occupations/Industries of non-teachers may be unevenly distributed. Influenced by inequities across local/ regional economies Teachers don't typically move to "comparable" professions
Hedonic Wage	Provide wage required for recruiting and retaining teacher of specific quality attributes	Wages of teachers by background attributes, location & working conditions	School district	Only approach to consider localized work conditions	Strongly influenced by the current single salary schedule

3.0 National Standards: NCES Wage Variation Indices

In the 1990s, the National Center for Education Statistics commissioned Jay Chambers of the American Institutes for Research (AIR) to develop a national teacher cost index based on data from the NCES Schools and Staffing Survey's of 1987-88 and 1993-94.

Chambers' Teacher Cost Index (TCI) applied a hedonic model to estimate differences in the price of teachers across and within states. The wage model estimated cost-related differences while holding constant discretionary differences. As discretionary factors, Chambers included teacher characteristics such as educational preparation, experience levels, composition of teachers with respect to race, gender, age and maturity and job characteristics including class size, subject matter and type of classes. Most of these factors, which involve "who is hired" and "how they are assigned" are within the discretion of local administrators. Chambers' cost factors

included those that affect the desirability of a particular geographic location like climate, composition of student enrollment, crime rates and proximity to an urban area (Chambers, 1999).

Chambers' also estimated cost indices for administrators, other non-certificated staff and non-personnel (utilities, materials & supplies etc.) costs. Each of these indices attempted to separate cost-related differences from discretionary differences. Chambers then constructed a weighted average of these indices, according to their share of typical school budgets, in order to construct an overall geographic cost of education index, or GCEI. Teacher wages explain a substantial portion of the overall GCEI.

One criticism that has been levied against the GCEI and underlying TCI is that the indices tend to heavily favor major metropolitan areas, and may fail to capture the difficulties of recruiting and retaining quality teachers in remote rural areas. In addition, the NCES hedonic index and GCEI suffered from the typical data problems of hedonic models, failing to sufficiently capture potential wage premiums required for poor urban districts adjacent to affluent suburban ones (See Baker, in press).

As an alternative, the National Center for Education Statistics contracted Lori Taylor of Texas A&M to produce a comparable wage index for teacher labor markets across the country in 2005 (Taylor & Glander, 2006). Taylor's comparable wage index uses data from the Individual Public Use Microdata Sample (IPUMS 5-percent). IPUMS contains information on earnings, place of work, occupation and demographics. The unit of analysis is the labor market, with urban district wage indices calculated for corresponding metropolitan areas and rural district wage indices based on corresponding rural areas, which usually include multiple counties.[3] To construct the comparable wage index, Taylor uses earnings data on college graduates to construct

[3] Note that the multiple county clustering for rural labor markets is not based on the view that multiple rural counties make up distinct labor markets, but rather that to run the statistical analysis required sufficient sample sizes within geographic areas. Single rural counties were insufficient.

a regression model in which the dependent variable is the log of the annual wage. Independent variables include race, educational attainment, amount of time worked, occupation and industry of each individual in the national sample, and an indicator variable for each labor market area.

Unfortunately, IPUMS data are decennial, and there exists the likelihood of significant regional convergence or divergence of wages over a ten year period. Taylor addresses this problem by generated annual updates of the Comparable Wage Index (CWI) using data from the Occupational Employment Statistics data set from the Bureau of Labor Statistics. OES contains average annual earnings by occupation. But, OES provides no information about individual worker characteristics and thus cannot be used for developing the baseline index. OES data are used to determine the rate of wage increase, by occupation and labor market and then applied to baseline CWI values to generate updates.

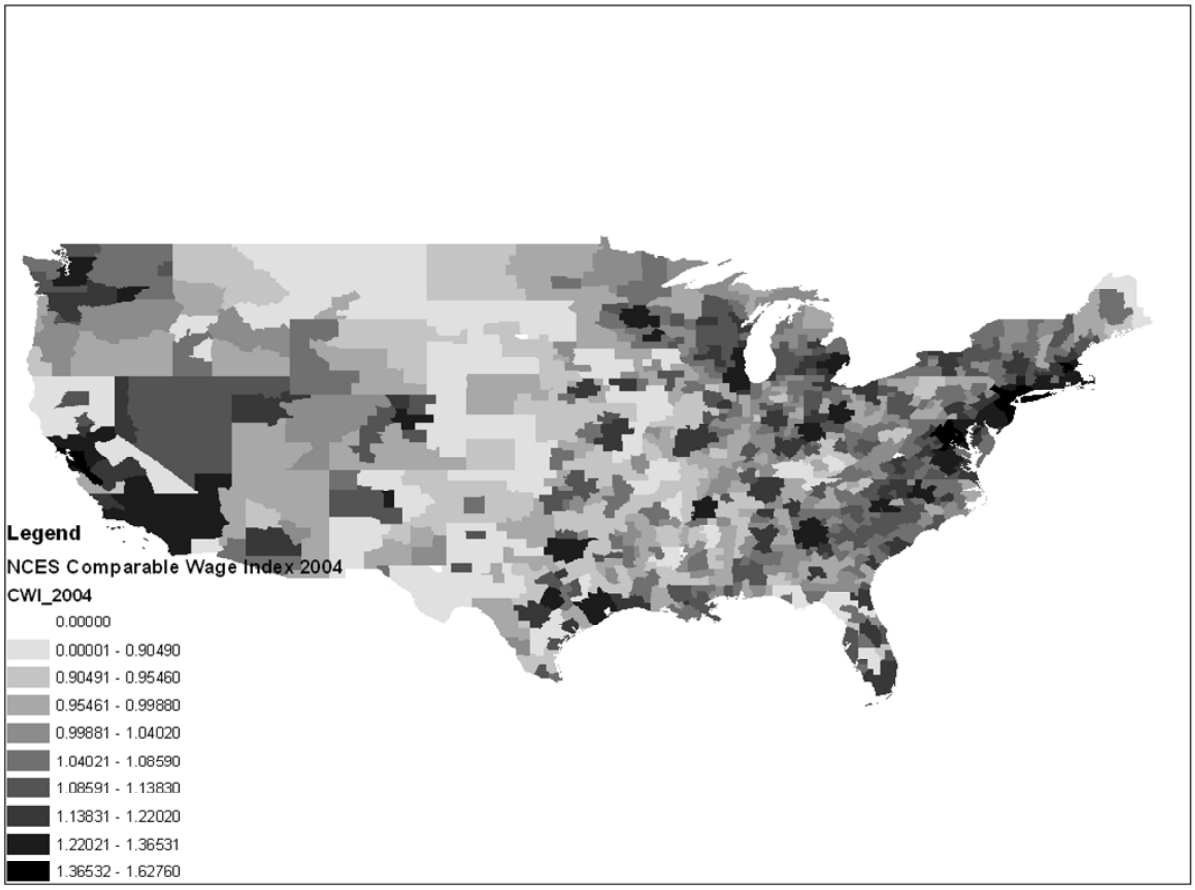
Figure 1 displays the national, county level map of the new CWI with shading representing standard deviations from the un-weighted national, county level mean CWI. There are at least a few areas around the country where relatively high wage (dark) labor markets are immediately adjacent to well below average wage (light) labor markets. For example, on the southeastern boundary of the Kansas City metropolitan area, competitive wages drop abruptly from 19% above national average to 14% below. Such abrupt changes raise some concern for direct application of the index in state school finance policy. A difference of greater than 30% in wage adjustment along a county border could create significant labor market distortion, drawing teachers into jobs in school districts on the outer fringe of those areas defined as labor markets (usually metropolitan area labor markets).

Recall that a CWI is not intended to capture district-to-district working condition differences. Abrupt changes in competitive wages between labor markets may disadvantage

higher poverty rural and small town districts that lie on the edge, but just outside of higher wage metropolitan areas. Those caveats aside, the new NCES CWI presents an intriguing alternative perspective on wage variation across and within states.

Whatever shortcomings may exist for either or both NCES indices herein, both provide important national standards as indices themselves and for the empirical methods and conceptual approach by which comparable wage and hedonic indices should be estimated. Both provide guidance on potentially useful data sources, geographic area definitions, and variable selection for regression models. Indeed both have their shortcomings, as will be touched upon at a few points in this article. Most of those shortcomings result from data limitations.

Figure 1
NCES Comparable Wage Index 2004



Data Source: Taylor, L. L., and Glander, M. (2006). *Documentation for the NCES Comparable Wage Index Data File* (EFSC 2006-865). U.S. Department of Education. Washington, DC: National Center for Education Statistics. http://www.nces.ed.gov/edfin/pdf/2006865.pdf

4.0 Design and Implementation of State Adopted Indices

Table 2 summarizes the indices, and basic features of their implementation for our six states. Four of the six use comparable wage approaches, with the most recent comparable wage index in New Jersey being based roughly on the methodology used in the NCES CWI. The New Jersey Geographic Cost Adjustment (GCA) is to be implemented with the recently adopted school finance formula overhaul, in 2008-09.[4] The New Jersey GCA assumes 90% of district costs vary by geography. A notable difference between the GCA and the NCES CWI is that the New Jersey index is applied to individual counties rather than labor markets.

The New York Regional Cost Index (RCI), updated in 2006, is applied to 9 geographically broad "labor force" regions and is constructed using "median salaries in professional occupations that require similar credentials to that of positions in the education field." (p. 2) The Missouri Index, or *Dollar Value Modifier* (DVM), is a crude version of a comparable wage approach, using the *wage per job*[5] of residents of each metropolitan or micropolitan area across the state and in counties where those counties lie outside of core based

[4] http://www.state.nj.us/education/sff/

[5] "County wage per job", the total county wage and salary disbursements divided by the total county wage and salary employment for each county and the city of St. Louis as reported by the Bureau of Economic Analysis of the United States Department of Commerce for the fourth year preceding the payment year;

(b) "Regional wage per job":

a. The total Missouri wage and salary disbursements of the metropolitan area as defined by the office of management and budget divided by the total Missouri metropolitan wage and salary employment for the metropolitan area for the county signified in the school district number or the city of St. Louis, as reported by the Bureau of Economic Analysis of the United States Department of Commerce for the fourth year preceding the payment year and recalculated upon every decennial census to incorporate counties that are newly added to the description of metropolitan areas; or if no such metropolitan area is established, then:

b. The total Missouri wage and salary disbursements of the micropolitan area as defined by the office of management and budget divided by the total Missouri micropolitan wage and salary employment for the micropolitan area for the county signified in the school district number, as reported by the Bureau of Economic Analysis of the United States Department of Commerce for the fourth year preceding the payment year, if a micropolitan area for such county has been established and recalculated upon every decennial census to incorporate counties that are newly added to the description of micropolitan areas; or

c. If a county is not part of a metropolitan or micropolitan area as established by the office of management and budget, then the county wage per job, as defined in paragraph (a) of this subdivision, shall be used for the school district, as signified by the school district number; http://www.senate.mo.gov/05info/billtext/tat/SB287.htm

statistical areas. The county or regional wage per job is then divided by the state median wage per job (localized mean over state median). The wage index is then created by applying 15% of the difference between localized (county or CBSA) wage per job and state median wage per job.[6] Next, index values below the state average are leveled up to 1.0.

Indices in Colorado, Florida and Texas are older and based on differing conceptions. The Florida Price Level Index (FPLI), like the New York RCI, is based on wages for comparable workers, but across counties rather than larger geographic regions (Dewey, Denslow and Lotfinia, 2007). The Florida foundation formula does not apply directly the FPLI, but rather a District Cost Differential (DCD), based on a three-year average of the FPLI, and adjusted to assume that 80% of district costs vary by geography.

Colorado is the only state among those included which uses a Cost of Living Index, the potentially most problematic approach. The index is updated every two years and is based on relative costs of housing, goods and services, transportation and taxation based on the weighted distribution of where teachers who work in any given district happen to live (identified as school district labor pool areas) (Godshall, 2006). Finally, Texas is the only among our states using an hedonic wage model based index, estimated in 1990 and based on data on teacher characteristics, school, district and community characteristics (See Alexander et al., 2001).

Implementation of cost indices in state school finance formulas is as critical to their evaluation as the index itself. In many cases, the full value of the index is not carried through to calculation of need adjusted foundation aid per pupil. Note that in New Jersey, Florida and Missouri, the magnitude of the wage indices is reduced to reflect that the indices apply to only a portion of district costs. In other cases, indices themselves reflect the full range of wage

[6] (11)] (5) "Dollar value modifier", an index of the relative purchasing power of a dollar, calculated as one plus fifteen percent of the difference of the regional wage ratio minus one, provided that the dollar value modifier shall not be applied at a rate less than 1.0. http://www.senate.mo.gov/05info/billtext/tat/SB287.htm

variation, but are applied to only a share of revenue calculation in the aid formula. In some cases, the share of revenues adjusted is constant across settings, and in other the share of resource adjusted for each school district may vary.

Colorado and Texas apply their cost indices to only a portion of foundation aid. In Texas, in 2003-04, the state operated a two tiered foundation formula with weightings for student needs. The state applied the wage adjustment index (Cost of Education Index, or CEI) to 71% of first tier funding and to 50% of second tier funding. 71% of each district's *Basic Allotment* is first adjusted by the CEI to yield an *Adjusted Basic Allotment*. Then, scale and sparsity adjustments are applied, by multiplying each districts scale/sparsity weighting times the *Adjusted Basic Allotment* to yield an *Adjusted Allotment.* This *Adjusted Allotment* is then multiplied times a districts weighted pupil count to yield the foundation (Tier I) allotment for each district.

Colorado is similar to Texas in that the Cost of Living Adjustment (COLA) is applied to only a portion of the base funding. But, in Colorado, each district is assigned a unique personnel cost factor or share of their foundation funding that is to be adjusted for personnel costs. Like Texas, the base funding is first partially (but varied by district) adjusted using the COLA. Next, the COLA adjusted base funding is multiplied by an *economies of scale* weighting for small districts. Finally, the scale adjusted base funding is multiplied by student need factors, including a poverty concentration based (varied by district) at risk funding factor. On the one hand, the full effect of the Texas and Colorado indices is muted by their partial application. But, the effect may be increased by its multiplication across district size and student need factors.

The remaining indices in Florida, Missouri, New Jersey and New York are all applied similarly, though we note that our application of the New York, New Jersey and Missouri indices are each hypothetical. In Florida, the District Cost Differential (DCD) based on the FCLI is

simply multiplied times the base funding times the need weighted pupil count. We apply our analysis using data from 2004-05. In Missouri, the state is phasing in a new pupil weighted foundation formula over a several year period. Like Florida, the Dollar Value Modifier is applied after multiplying need weighted students times the state's base aid per pupil. Small size adjustment is added separately. For Missouri, we simulate foundation funding at full implementation of the new formula. That is, we simulate what each district would receive in need and cost adjusted basic funding when applying the base aid per pupil of $6,117 to weighted pupil counts (based on free and reduced lunch, special education and limited English proficiency rates), and then applying the DVM.

Our applications of the wage indices are more speculative for New York and New Jersey. For New York, we adopt a need and cost adjusted formula simulation developed by Duncombe (2007), which, like the Missouri and Florida foundation formulas multiplies a need weighted student count times a foundation aid per pupil, then times the full value of the cost adjustment, in this case the New York RCI. In New York, our student need weightings include poverty weighting and weighting for limited English proficient children. Finally, our simulated application of the New Jersey wage index (GCA), is based on a more limited simulation, which also applies a need weighted student count to base funding, then times the GCA. For New Jersey, we include only the grade level and poverty based weightings (built on school year 2006-07 data).[7]

[7] Sufficient data were unavailable for more detailed calculation. The adopted formula first differentiates foundation funding by numbers of students in elementary, middle and high school. Then, a varied poverty weight is applied across districts depending on poverty concentration. But, children qualifying for free or reduced lunch are also differentiated by their grade level (multiplied times their grade level differentiated base funding). We lacked grade level data on free/reduced lunch. We applied the varied poverty weighting based on poverty concentration, but then applied that weighting to only the elementary level base funding. Further, while the new formula includes a weighting for limited English proficient children, the new formula reduces the weight for LEP children who already receive the poverty weighting. We lacked detailed data by grade level on LEP concentrations and their overlap with poverty concentrations. Finally, because special education aid is allocated flatly across districts under the new

Table 2
State Indices

STATE	Funding Formula Type	Wage Index Concept	Parameters Analyzed	Geographic Unit for Analysis	Geographic Unit for Application	Wage Index Application (Base)	Additive/ Multiplicative
Colorado (2006-07)	Weighted Pupil Foundation	Cost of Living	Housing, Transportation, Goods & Service	School District (based on teacher place of residence)	School District	Personnel Cost Share of Foundation (variable by district))	Applied at first step. Multiplicative with size adjustment and student weights
Florida (2004-05)	Weighted Pupil Foundation	Comparable Wage (based on private market wages)	Private sector wages	County	County (School District)	100% of Need-adjusted Foundation	Applied to need adjusted foundation (multiplicative with student weights). Declining enrollment & sparsity added on top.
Texas (2003-04)	Weighted Pupil Foundation with Weighted 2nd Tier Aid	Hedonic Wage	Teacher characteristics, school & district characteristics, community costs of living and amenities	District (teacher characteristics, district characteristics including population), Community (cost of living, amenities)	School District	71% of Basic Allotment ($2,537) (50% of 2nd Tier Revenue)	Applied at first step. Multiplicative with size adjustment and student weights
Missouri (Full Implementation of SB287)	Weighted Pupil Foundation	Comparable Wage	Gross county level tax returns per return filed	County (merged into CBSAs)	Metro & Micro CBSAs & Rural Counties	100% of Need-adjusted Foundation	Applied to need adjusted foundation (multiplicative with student weights)
New York (Simulation of RCI application)	Weighted Pupil Foundation	Comparable Wage	63 private sector occupations	9 labor regions	9 labor regions	100% of Need-adjusted Foundation	
New Jersey (Simulation of New Formula)	Weighted Pupil Foundation	Comparable Wage	Regression model of non-teacher wages	County	County	90%[a] of Need-adjusted Foundation	Multiplicative with Student Need Adjustments

[a] 90% calculation built into the GCA

5.0 Evaluation of State Adopted Indices

Table 3 provides the correlations between state adopted indices and NCES benchmarks. For some states, we include measures of both *index effects* and the index itself. By index effect, we mean the extent to which, when applied in the state funding formula, the index produces differentiation of foundation funding across districts. To calculate an index effect we apply the index in the foundation calculation as specified under existing statutes, and then we separately estimate the foundation calculation excluding the index. The index effect is the foundation calculation including the index, divided by the foundation calculation when the index is excluded.

$$\textbf{Index Effect} = \textbf{Foundation Estimate}_{\textbf{With Index}} / \textbf{Foundation Estimate}_{\textbf{No Index}}$$

Where the index is directly applied as the last step in foundation calculation, the index effect and the index should be one and the same. Recall that many of the indices themselves include policy determinations regarding the share of revenues to be adjusted.

Table 3 shows that the Missouri and New York indices share the highest correlations with the NCES CWI. Both states have significant variation in private sector wages from their major metropolitan to more remote rural areas. Because both states also have significant urban to rural differences in teacher wages, the state indices are also highly associated with the NCES GCEI, which was based on teacher wage variation.

Interestingly, while the New Jersey GCA is based on the NCES CWI methodology, it shares a relatively weak correlation with the CWI across New Jersey school districts. This likely occurs due to the choice to apply the analysis and resulting index to county level data instead of broader labor markets.

Table 3
Correlations with Benchmark Indices

		All Districts			Large Districts	
State		**CWI**	**GCEI**		**CWI**	**GCEI**
Colorado						
	Index	0.602	0.624		0.663	0.628
	Index Effect	0.605	0.550		0.655	0.491
Florida						
	Index	0.634	0.807		0.634	0.810
	Index Effect	0.627	0.802		0.627	0.805
Missouri						
	Index Effect	0.970	0.851		0.967	0.832
New York						
	Index Effect	0.904	0.855		0.894	0.831
New Jersey						
	Index Effect	0.685	0.793		0.670	0.796
Texas						
	Index	0.489	0.680		0.347	0.532
	Index Effect	0.496	0.689		0.357	0.545

Correlations weighted for district enrollment

Table 4 summarizes the relationships between NCES indices, State indices and poverty and housing values. For our poverty measure, we use district level data from the U.S. Census Bureau's Small Area Income and Poverty Estimates (SAIPE), for public school enrolled children between the ages of 5 and 17. For housing values, we use median housing values from U.S. Census 2000, drawn from the School District Demographics System (U.S. Census and NCES). In Colorado, both NCES indices, the state index effect and the state index itself are negatively associated with poverty and positively associated with housing values. But, the state index itself is most negatively associated with poverty and most positively associated with housing values, suggesting that if the index was implemented at full effect, it may disadvantage higher poverty districts. As implemented, however, this problem is muted.

In Florida, only the CWI is negatively associated with poverty, but the state's own index and its effect are positively associated with poverty. All indices are positively associated with

housing values. With counties and districts aligned, making for geographically large districts, the combined positive relationship between the state indices and both poverty and housing is largely driven by Dade County.

In Missouri, all indices are negatively associated with poverty, where many of that state's highest poverty districts are in the rural southeastern portion of the state, but higher teacher wages and higher private sector wages are in the metropolitan areas. All indices are also positively associated with housing values. In many ways, New York and Missouri are similar, with both teacher and private sector wages being much higher in major metropolitan areas, and housing values being similarly higher in those areas. While Missouri has very high levels of rural poverty in addition to concentrated urban poverty, poverty in New York State is more concentrated in urban areas. As such, the RCI and CWI are positively associated with poverty in New York State and positively associated with housing values.

New Jersey's new GCA appears more potentially problematic. While the CWI and GCEI for New Jersey are both positively associated with poverty, the new state index has a slight negative correlation with poverty. In addition, while all indices are positively associated with housing values, the new state index has the highest positive association with housing values. It is conceivable that use of county level analysis has favored those counties having more consistently high wage earners, and/or lacking lower wage earners, despite controls for occupation, industry, education level and age in the models. Two particularly affluent New Jersey Counties (Morris and Somerset) receive the highest geographic cost adjustment, with lower indices for neighboring counties (Union and Essex) which also include high wage earners but along side poorer urban core areas.

Table 4
Correlations with Poverty and Housing Values

		Correlation with Poverty				Correlation with Housing Values		
		All Districts		*Large (>2,000 Enrolled) Districts*		*All Districts*		*Large (>2,000 Enrolled) Districts*
Colorado								
	CWI	-0.289		-0.221		0.448		0.452
	GCEI	-0.232		-0.131		0.473		0.460
	State Index Effect	-0.160		-0.002		0.624		0.426
	State Index	-0.323		-0.240		0.749		0.646
Florida								
	CWI	-0.242		-0.231		0.583		0.576
	GCEI	0.043		0.059		0.689		0.684
	State Index Effect	0.232		0.240		0.667		0.665
	State Index	0.226		0.235		0.671		0.669
Missouri								
	CWI	-0.339		-0.228		0.429		0.302
	GCEI	-0.276		-0.154		0.477		0.325
	State Index Effect	-0.359		-0.246		0.445		0.315
New York								
	CWI	0.376		0.384		0.761		0.730
	GCEI	0.090		0.041		0.745		0.718
	State Index Effect	0.280		0.269		0.716		0.686
New Jersey								
	CWI	0.056		0.082		0.377		0.325
	GCEI	0.203		0.217		0.281		0.242
	State Index Effect	-0.030		-0.031		0.482		0.457
Texas								
	CWI	-0.397		-0.450		0.478		0.430
	GCEI	-0.140		-0.174		0.370		0.281
	State Index Effect	0.260		0.321		0.029		-0.135
	State Index	0.266		0.328		0.020		-0.145

Correlations weighted for district enrollment

The Texas hedonic Cost of Education Index is the only index to reveal a negative relationship with housing values, among large districts and a relatively weak relationship with housing values across all districts. In Texas, both NCES indices display negative relationships with poverty and positive relationships with housing values, but by contrast, the state's own index is positively associated with poverty.

Table 5 plays out alternative scenarios for indexing for each state. In the first scenario, we apply current state indices to generate district foundation revenue levels. Then, to calculate relative equity of those foundation levels, we deflate those revenues by the full value of the

NCES CWI and calculate Gini Coefficients and Theil Coefficients for all districts then large districts. Next, we deflate those revenues by the full value of the NCES GCEI instead of the CWI, and calculate Gini Coefficients and Theil Coefficients. In this case, we are evaluating the extent of cost adjusted variation in per pupil revenues when those revenues include the state wage index, assuming either the NCES CWI or NCES GCEI to be an appropriate deflator.

Alternatively, we replace the state adopted indices with each the CWI and the GCEI, and then re-estimated cost adjusted equity measures, using the alternate NCES index as the deflator (because if we use the same index in the revenue calculation and in the deflator for equity calculation, the two cancel out). Understanding that none of the above cases is either an ideal application of policy, or an ideal measurement of equity, we ask simply which case reveals the least equitable conditions. That is, which combination of deflator for equity calculation and wage adjustment policy for revenue estimation reveals the greatest potential equity problems – under over compensation of school districts relative to needs as estimated by NCES?

In Colorado, Florida, Missouri and Texas, the Gini and Theil coefficients are largest – least equitable – for the case in which we use the current state wage index as the policy tool, and where we use the NCES CWI to adjust, or deflate, per pupil revenues in our equity analysis. That is, in each of these states, the current wage index tool fails to adjusted school district revenues in a manner consistent with the NCES CWI. Equity changes are relatively small suggesting perhaps that any negative effects of using state developed indices versus NCES indices may be small.

In New Jersey and New York, state indices fair somewhat better, and the least equitable conditions occur when applying NCES indices for policy adjustment with the alternative NCES index for equity measurement. This likely occurs because the state's own comparable-wage-type indices share many properties (as indicated by the previous correlations) with the NCES CWI,

but that both the state index and the NCES CWI differ from the NCES GCEI. Recall that the NCES CWI varies by large geographic areas – core based statistical area – and not by district within those areas. The New York RCI varies across even larger geographic areas, whereas the NCES hedonic varies by district. The New Jersey GCA falls somewhat in between, varying by county, where many counties may include only a handful of school districts.

Table 5

Gini and Theil Coefficients under Alternative Scenarios

	Colorado (2006-07 Actual)		Florida (2003-04 Actual)		Missouri (Hypo. Full Imp. SB287)		New Jersey Base, At Risk and GCA '08		New York (Hypothetical)		Texas (Tier 1 2003-04)	
	Observed	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*
All Districts												
Revenue with State Index (CWI Deflated)												
Gini	**0.063**	**0.005**	**0.033**	**0.006**	**0.058**	**0.002**	0.042	0.002	0.107	0.015	**0.119**	**0.005**
Theil	**0.010**	**0.001**	**0.002**	**0.001**	**0.005**	**0.000**	0.003	0.000	0.020	0.003	**0.024**	**0.002**
Revenue with State Index (GCEI Deflated)												
Gini	0.048	0.007	0.016	0.002	0.052	0.003	0.038	0.002	0.132	0.013	0.088	0.004
Theil	0.007	0.001	0.001	0.000	0.004	0.000	0.002	0.000	0.029	0.005	0.015	0.001
Revenue with GCEI (CWI Deflated)												
Gini	0.053	0.004	0.029	0.005	0.051	0.003	**0.046**	**0.002**	0.099	0.023	0.095	0.004
Theil	0.006	0.001	0.002	0.001	0.004	0.000	**0.003**	**0.000**	0.017	0.006	0.015	0.001
Revenue with CWI (GCEI Deflated												
Gini	0.046	0.005	0.024	0.004	0.047	0.004	0.042	0.003	**0.142**	**0.017**	0.062	0.003
Theil	0.005	0.001	0.001	0.000	0.004	0.001	0.003	0.000	**0.033**	**0.007**	0.008	0.001
Large Districts												
Revenue with State Index (CWI Deflated)												
Gini	**0.042**	**0.005**	**0.032**	**0.005**	**0.050**	**0.002**	0.040	0.002	0.106	0.014	**0.092**	**0.005**
Theil	**0.003**	**0.001**	**0.002**	**0.001**	**0.004**	**0.000**	0.002	0.000	0.020	0.003	**0.013**	**0.001**
Revenue with State Index (GCEI Deflated)												
Gini	0.028	0.005	0.016	0.003	0.044	0.005	0.036	0.002	0.133	0.016	0.060	0.003
Theil	0.001	0.000	0.001	0.000	0.003	0.001	0.002	0.000	0.030	0.006	0.005	0.001
Revenue with GCEI (CWI Deflated)												
Gini	0.038	0.003	0.028	0.004	**0.050**	**0.004**	**0.042**	**0.002**	0.097	0.022	0.076	0.003

	Colorado (2006-07 Actual)		Florida (2003-04 Actual)		Missouri (Hypo. Full Imp. SB287)		New Jersey Base, At Risk and GCA '08		New York (Hypothetical)		Texas (Tier 1 2003-04)	
	Observed	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*	*Observed*	*Std. Err.*
Theil	0.002	0.000	0.002	0.001	**0.004**	**0.001**	**0.003**	**0.000**	0.016	0.005	0.009	0.001
Revenue with CWI (GCEI Deflated)												
Gini	0.035	0.003	0.024	0.003	0.046	0.007	0.041	0.004	**0.144**	**0.019**	0.044	0.003
Theil	0.002	0.000	0.001	0.000	0.003	0.001	0.003	0.000	**0.035**	**0.008**	0.003	0.000

Spatial Considerations Matter

The relatively modest statewide equity shifts that occur when switching out indices and deflators in the previous analysis suggest that states' own approaches to designing and implementing wage indices may not be hugely problematic – at least for the six states under consideration here. However, on closer look, state's own indices may provide significantly inappropriate advantage or disadvantage to some school districts, relative to NCES indices. Here, we use New Jersey as an example, a state which largely followed the NCES comparable wage index methodology, but for a few important changes. One critical difference is the use of counties as geographic areas for applying the index instead of core based statistical areas. An important difference between counties and CBSAs is that CBSAs are defined by the census bureau as collections of counties that radiate from a population center, where the expansiveness of the CBSA is dependent on a number of parameters. A CBSA necessarily includes a core, and its fringe, or suburbs and is therefore likely to be relatively heterogeneous in terms of population and employment options. Counties by contrast are smaller geographic areas and may consist exclusively of affluent suburbs, while other adjacent counties may encompass only the urban core or the urban core and its immediate fringe.

Figure 1 plots the relative effects of the New Jersey county based index compared to applying the NCES CWI in its place in our simulations. Districts are sorted by poverty rates along the horizontal axis and districts are labeled by the county in which they lie. Several low poverty districts in Warren and Somerset counties receive a substantial boost, in excess of 5% under the NJ GCA relative to the NCES CWI. Low poverty Sussex county districts receive a comparable relative loss. Low poverty districts in Morris County also receive a sizeable boost relative to what they would receive under the CWI. High poverty districts in Hudson, Passaic

and Ocean Counties also receive less relative adjustment under the NJ GCA than they would under the NCES CWI.

Figure 1
Gains/Losses from NJ Index over alternative application of ECWI

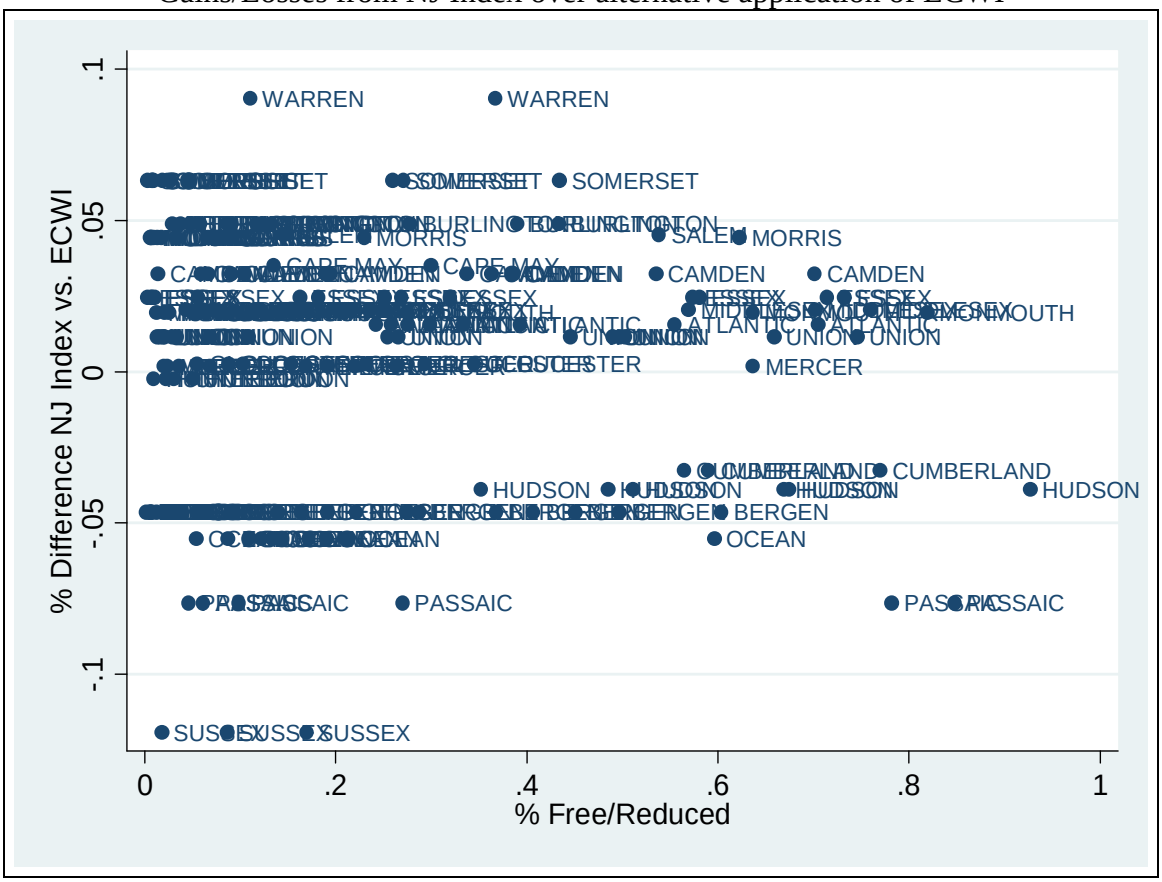


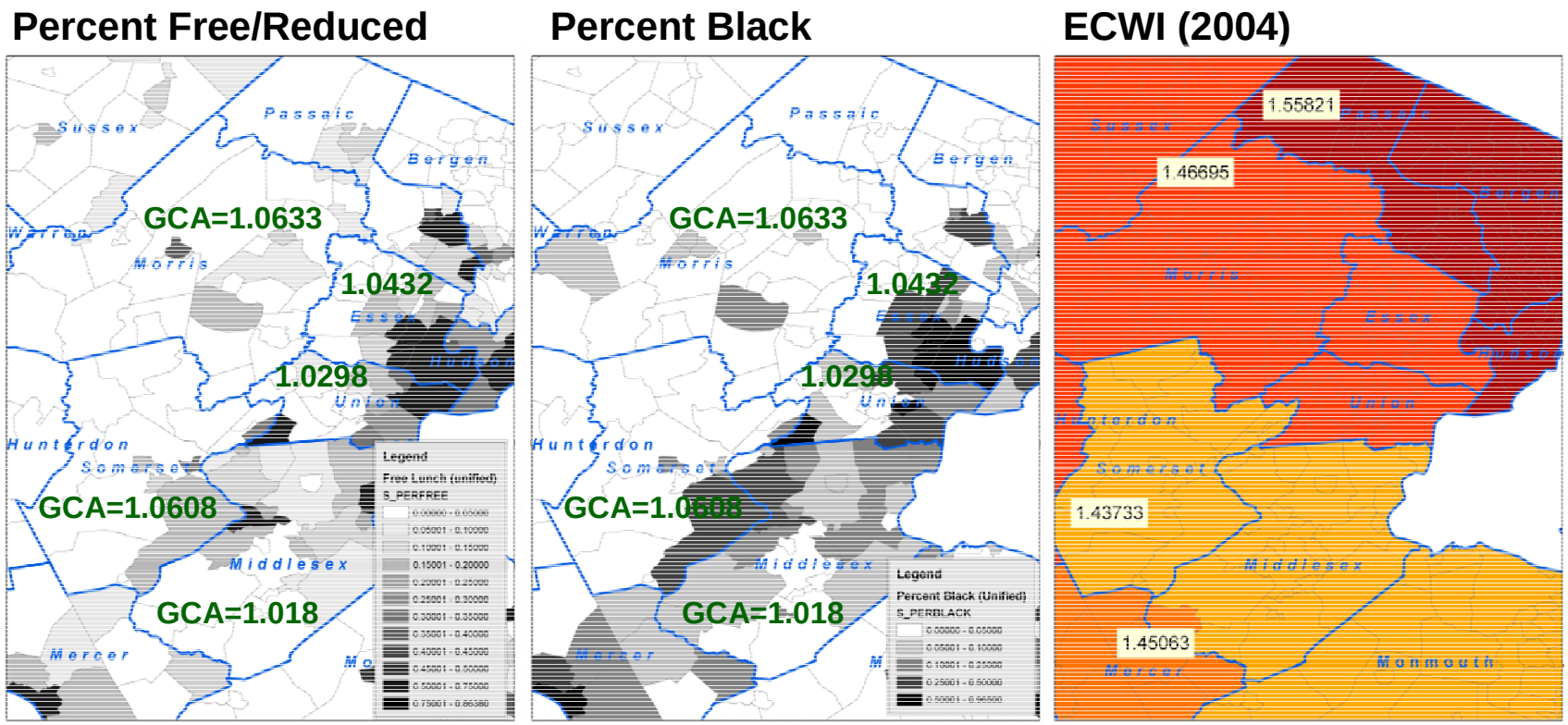
Figure 2 reveals why these differences occur. Again, the NJ GCA is applied by county and the NCES CWI by Core Based Statistical Area. The two highest GCA's are provided to Morris and Somerset counties, which lie immediately to the west of Essex and Union counties. Under the NCES CWI, Essex, Union and Morris county share an index and Somerset and Middlesex share an index. When organized in this way, the populations within the index boundary are far more heterogeneous. As counties, Morris and Somerset Counties have relatively

little poverty and few minorities and are among the most affluent counties in the country. Neither has a poor, urban core.

While comparable wage approaches attempt to account for differences in wages between individuals in comparable professions at comparable education level, data are insufficient to fully account for differences that might exist, for example, between the wages of physicians employed in inner city Newark public hospitals (Essex County) versus those employed in private hospitals in Morris county, or inner city versus suburban lawyers whose degree levels and experience may be held constant, but unmeasured education credentials (law school rank or quality) may vary widely.

The county level approach applied by New Jersey explains the difference in correlation between the New Jersey index and poverty and the NCES indices and poverty. Under the NCES indices, high poverty urban core school districts are the center of high wage core based statistical areas. But, under the NJ GCA, low poverty counties such as Morris and Somerset are cut from their core and awarded a higher index value. It makes little sense, for example for Somerset Hills Regional School District – among the most affluent in the nation – to receive 3% more in wage adjustment than Union City a high poverty urban core district, which lies a short drive to the east.

Figure 2
Distribution of New Jersey Student Populations and application of the CWI



6.0 Conclusions and Policy Implications

On average, measured as patterns across all districts in a state, state adopted wage adjustment indices do not appear to result in considerable reductions in equity. It remains questionable, however, whether these state policies result in legitimate improvement to equity as a general pattern.

In recent years, state legislatures and consultants advising them have become savvy regarding the types of variables that might be used to account for labor market behaviors of teachers under the hedonic approach or non-teachers under a comparable wage approach. Comparable wage approaches appear relatively common in recent adoptions. Further, data quality and data timeliness have improved, especially for constructing comparable wage type indices via methods similar to those used by NCES. Despite the wealth of new data available policymakers and those that advise them must remain cognizant of the potential shortcomings of those data, such as the fact that while we are now better able to evaluate across large populations the education and salary levels of workers, we still lack sufficient detail in some cases to differentiate more precisely, important quality differences across workers and their training.

Perhaps most importantly, our New Jersey example emphasizes the need to be more aware of the influence of geography on the construction and application of wage indices. Wage indices are all about geography and incentives, where the policy objective of those indices is to support comparable quality of teaching across labor markets or school districts within a state, and where those labor markets and school districts share important geographic relationships. Geography matters in the construction of indices in many ways, including defining the heterogeneity of the workforce that yields any one labor market's index value, as well as determining the sample size of workers in specific categories of occupations and industries.

Geography matters in the policy application of indices because school districts geographically closer to one another in adjacent labor markets likely compete for the same teachers. As such, implementing wage indices requires careful consideration of the spatial arrangement of schools and districts across labor market lines. Indeed no available wage index resolves perfectly the nuanced spatial concerns herein, including the recently developed NCES comparable wage index, which in many cases reveals dramatic differences in competitive wages between metropolitan areas and districts on their immediate, rural fringe. Such differences may be problematic in policy application.

Given difficulties in estimating hedonic models and the relative complexity of hedonic models, it makes some sense that legislatures have been more open to comparable wage methods in recent years, including the recent Missouri, New York and New Jersey indices. We find it intriguing however, that while some including New Jersey have openly acknowledge the NCES CWI, they have still chosen to independently develop their own indices, making key changes that compromise the integrity of the index. Notably, only the New Jersey index was developed since the release of the NCES CWI. While Missouri's choice to rely solely on average wage per worker seems more problematic than the New Jersey choice to alter the geography of the index, the Missouri index remained more consistent with the NCES CWI. In either case, however, one must ask, why not simply use the CWI or at least adhere more closely to its underlying methodology.

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