Rearranging Deck Chairs in Dallas: Contextual Constraints and Within District Resource Allocation in Urban Texas School Districts

Abstract

The goal of this study is to explore simultaneously, resource allocation across schools within large urban school districts and resource allocation across all schools within major metropolitan areas that include those urban districts in the state of Texas. The present study uses a 3-year panel, from 2005 to 2007, for Texas elementary schools in the Houston, Dallas, Austin and San Antonio Core Based Statistical Areas. Large city districts under investigation include Houston, Dallas, Ft. Worth, San Antonio and Austin. We find that within the state of Texas, the relative competitive position of urban core districts varies widely – with Austin possessing a significant advantage over surrounding districts, Houston and Fort Worth maintaining relative parity with surrounding districts, and Dallas and San Antonio at a relative disadvantage. We find that on average current spending in the metropolitan areas surrounding these large urban districts is progressively distributed with respect to poverty rates, with an average implicit weight of 25% (25% higher spending in a school with 100% poverty compared to a school with 0% poverty). This spending difference, however, is lower than our estimated additional cost of about 44%. In Dallas, spending fell well below that of surrounding districts and was less progressively distributed. In San Antonio, spending fell below surroundings but was progressively distributed. Austin and Fort Worth also progressively distributed spending. Houston, while spending more on elementary schools than surrounding districts, provided a relatively flat distribution of that spending, advantaging lower poverty schools to the disadvantage of higher poverty ones.

1.0 Introduction

The goal of this study is to explore simultaneously, resource allocation across schools within large urban school districts and resource allocation across all schools within major metropolitan areas that include those urban districts in the state of Texas. In the past few years, there has been renewed interest in the topic of within district resource allocation, specifically the allocation of equitable per pupil budgets across schools within districts (Author, 2009). In some cases, authors have suggested that state legislatures have met their end of the bargain by providing sufficient support to school districts – specifically large urban ones – and now the burden rests on large urban school districts to keep their end of the bargain by ensuring comparable equity across schools within school districts (Carr, Gray and Holley, 2007). Others have gone even further to suggest that “Today’s urban school districts have more than enough money in their budgets to do their jobs well.” (Ouchi, 2004, p. 25)

Certainly it makes sense that if states have held up their end of the bargain to achieve greater equity across school districts within the state then local school districts have a comparable obligation to ensure resource equity across schools and children within the district. In some cases, single school districts serve over 10% of a state’s student population and in a few cases much larger shares. If a state legislature wished to ensure that equitable dollars reached individual schools and guarantee that local district policies do not interfere with state efforts to improve equity, a state legislature might simply dissolve local school district boundaries and reorganize state financing to target funds directly to individual school sites rather than school districts in order to achieve statewide equity across schools. Such proposals have recently been suggested in Ohio, but even the boldest proposals to this effect capitulate to the deeply embedded geographic construct, property taxing and local budgeting authority of *the local public school district* (Fordham Institute, 2008). With Hawaii as a single notable exception, it would appear that *local school districts* are here to stay for the foreseeable future, defining separate operating spaces for clusters of schools within labor markets and within states and altering both governance and school revenue flow in ways that may continue to disrupt the state objective of equity across all individual schools – and the children they serve – within a state.

As such, when evaluating school-level equity in resource allocation, researchers must be careful not to take their eye of one ball – between district equity – while watching with tunnel-vision the other – within district equity. Existing school level equity studies have evaluated (a) changes in within district equity over time, usually within one or a handful of districts, (b) differences in within-district equity across districts within a state and (c) have asked whether within district equity is better or worse than between district equity. But each of these approaches fails to evaluate the intersection of the within and between.

Further, school level equity studies in the 1990s focused primarily on nominal variation in per pupil spending across schools and school districts, whereas more recent district level equity analyses have attempted to adjust for the additional costs of achieving comparable educational outcomes across districts of varied sizes, facing varied labor market conditions and serving varied student populations (Duncombe and Yinger, 2008). The goal of this study is to fill both of these voids, by considering simultaneously the distribution of resources across schools within large urban Texas districts and in their surrounding metropolitan areas and to estimate a model of the relative costs of providing equal educational opportunity across Texas elementary schools and use that model for adjusting the value of financial inputs toward achieving common outcomes.

Relevant Literature on Within-District Resource Allocation

The study of within district resource allocation in public education is not new. Studies conducted in the 1990s found significant disparities in resources within districts. Burke (1999) in particular shows how *gini* coefficients estimated to resource distributions at the school rather than district level reveal significant intra-district disparities that in some states exceed inter-district disparities (Illinois and New York). Steifel, Rubenstein and Berne (1998) analyzed school level data from four large urban districts (Chicago, Fort Worth, New York and Rochester) in an effort to measure within district disparities in resources. Stiefel, Rubenstein and Berne asked two basic questions. First, how much variation exists across school level budgets within the districts? Second, to what extent is that variation associated with factors that may affect the costs of providing equal educational opportunity across those schools – most notably, rates of children in poverty? Like Burke (1999), the authors found significant variation in resources across schools within districts, but also found that some of that variation was positively associated with poverty rates across schools. This finding, however, was not systematic across settings or school types. For example, Rochester middle schools showed stronger positive relationships between poverty and resources than Rochester elementary or high schools.

In a follow-up of previous research, Rubenstein, Schwartz, Stiefel, and Bal Hadj Amor (2007) confirm and expand on earlier findings regarding the distribution of teachers by their qualifications across schools: “Using detailed data on school resources and student and school characteristics in New York City, Cleveland and Columbus, Ohio, we find that schools with higher percentages of poor pupils often receive more money and have more teachers per pupil, but the teachers tend to be less educated and less well paid, with a particularly consistent pattern in New York City schools.”

At least two other studies have used panels of Texas school level expenditure data to evaluate within district resource allocation. Ajwad (2006) used data on Texas school level expenditures for elementary schools to evaluate whether Texas school districts have targeted greater resources toward schools in higher poverty neighborhoods. Using fixed effects expenditure functions, Ajwad shows that Texas school districts, on average, target additional resources toward elementary schools in higher poverty neighborhoods, using neighborhood resident population characteristics rather than school enrollments. Ajwad finds that on average, the dollar differences in targeted funding are relatively small, and does not disaggregate findings for specific large districts or their neighbors.

Roza , Guin, Gross and Deburgomaster (2007) also use Texas school level expenditure data to evaluate changes in internal resource allocation from 1994 to 2003. Rather than use an expenditure function framework, like Ajwad (2006), Roza and colleagues adopt an approach which involves calculating a Weighted Student Index (WSI), to track equity levels and changes over time. A significant shortcoming of the *WSI* approach, however, is that it fails to measure differences in resources with respect to student population variation across schools, and measures instead whether the child in poverty in one school receives the same level of resources as the child in poverty in another (even if that level is $0, or 0% more than the non-poor child.).[1]

[1] Roza and colleagues also test whether variations in their WSI are a function of (a) school grade level, (b) percent white in the school, (c) teacher experience, and (d) the academic rank of the school in the state. The authors suggest that this analysis is undertaken with the goal of determining whether observed resource variation (as measured by the WSI) is a function of "intentional" and "unintentional" factors. It is difficult to interpret, however, how this ad-hoc mix of outcome measures, organizational features and racial composition relates to more common sets of "cost" factors, or factors outside the control of local school officials that influence the costs of achieving any given level of outcomes (see Duncombe and Yinger, 2008). The dependent variable - WSI - measures resource variation in terms of differences across schools between student subgroups, rather than aggregate resource differences across schools with respect to population differences across schools. Using per pupil expenditures as the dependent variable and identifying standard cost factors as independent variables in an expenditure function framework provides more straightforward interpretation, at least with respect to whether resource variation is a function of uncontrollable cost factors.

The extent to which resources are targeted on the basis of poverty or other costs and needs is overlooked.

Numerous issues remain unresolved or underexplored. First, neither Ajwad, or Roza and colleagues explore systematically the relationship between “cost” factors and school level budgets per pupil both within and across large urban Texas school districts. That is, are per pupil expenditures more or less sensitive to poverty or disability concentrations in Houston than in Dallas, Austin, Ft. Worth or San Antonio? Second, while Rubenstein and colleagues explore the inequitable distribution of teacher quantities and credentials across schools within and across large urban districts, those comparisons are made across widely varied state school finance and teacher credentialing policy contexts, as well as varied teacher and student demographic contexts (New York, Ohio).

Third, Author (2006), in a commentary, raise the concern that within district resource allocation - *tilting of the playing field* across schools within districts - might be constrained by the overall tilt of the playing field across schools across districts sharing the same labor market. That is, poor, urban core districts might have difficulty allocating resources away from “low need” schools and toward their “high need” schools, if neighboring, lower need districts have higher average resource levels coupled with more desirable working conditions for teachers. But, Author (2006) merely speculate that such conditions may be problematic, and provide only anecdotal evidence of concerns related to New York City.

Research Questions

The analyses in this article are organized around four research questions:

1. How do fiscal resource levels and teacher characteristics of urban core districts compare with their surroundings?
2. How do fiscal resources and teacher characteristics vary across schools within large urban districts?
3. How does need and cost related variation in fiscal resources across schools within large urban districts fit within the broader labor market of resource variation among schools in surrounding districts? That is, is the district a *sinking ship* facing potential constraints on within district re-allocation?
4. To what extent does existing variation in resources account for the additional costs of providing equal educational opportunity across schools within large urban districts and between large urban districts and their surroundings?

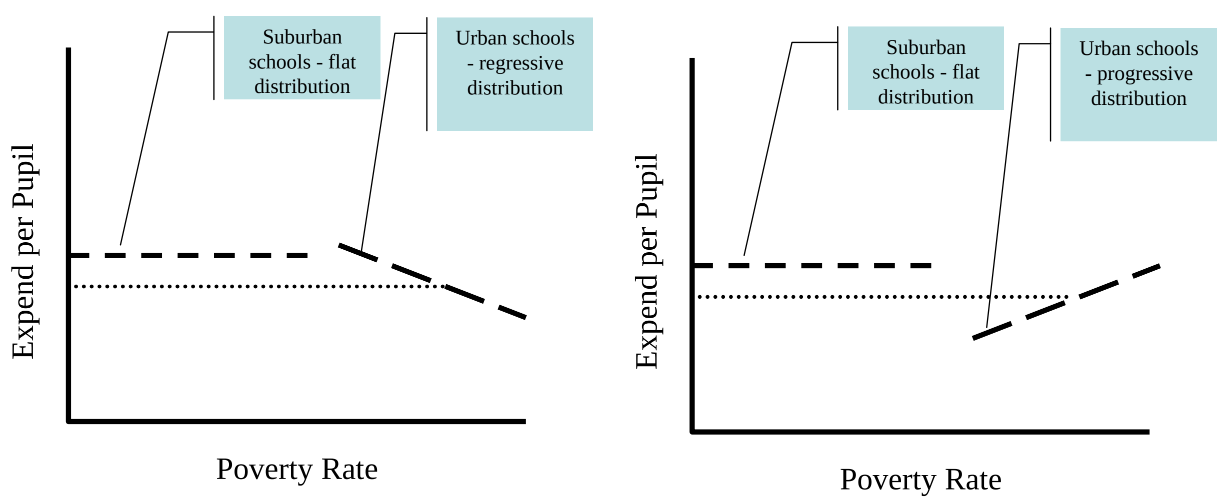
We begin by comparing the characteristics of our Texas large urban school districts with the aggregate of all other non-rural school districts sharing the same core based statistical area. We compare demographics, size and teacher characteristics for each. We are primarily interested in knowing whether the aggregate resources might be sufficiently competitive for the poor urban district, given the similarities to or differences from surrounding districts. Since our subsequent detailed analyses focus on the relative resource levels of elementary schools, it is also important for us to determine whether middle and secondary school spending per pupil is comparably lower or higher than surrounding schools, before casting those schools aside, in part because districts might reallocate resources across grade levels.

Next, we use school level regression models to decompose the factors most associated with variation in elementary school expenditures and variations in teacher characteristics across schools within districts. This analysis is followed by an analysis of per pupil spending across all schools within the labor market. Finally, applying an education cost function framework we evaluate whether cost adjusted per pupil expenditures are equitable between the large urban districts and their surroundings and across schools within the large urban districts.

This study adds to the current literature in several ways. First, this study considers not only the level and distribution of the district's own resources, but the competitive school finance and labor market context within which each district operates. In short, very few school districts are geographically isolated islands that can alter their own spending levels or distributions without consideration for spending and distribution behavior of their neighboring districts. Figure 1 provides a hypothetical illustration. Assume that a relatively high poverty urban core district spends, on average slightly less or about the same as neighboring districts having much lower poverty levels across most or all schools. Assume that the urban core district allocates greater resources to its own lower poverty schools (a regressive allocation, shown in the left panel of the figure), placing their spending levels slightly above those schools in neighboring districts. Under these initial conditions, the urban core district might be able to recruit and retain a small share of relatively high quality teachers into its lower poverty schools by providing almost comparable working conditions to those in neighboring districts, and perhaps even slightly better salaries or smaller class sizes. But, the internal allocation of the urban district, which leads to relatively competitive resources in lower poverty schools, puts its own high poverty schools at a substantial disadvantage.

If the urban district chooses to re-allocate resources "progressively" (positive slope across schools by poverty) within the same total budget constraint (pivoting on the same mean), the district may find itself in a more difficult position. The district's own low poverty schools would then have substantially fewer resources than lower poverty schools in neighboring districts, and the district's high poverty schools would have resources comparable to or slightly higher than much lower poverty schools in neighboring districts. Resources may remain insufficient in the highest poverty schools to recruit and retain quality teachers, and resources in the district's low poverty schools may be insufficient to compete with schools in neighboring districts. In short, context matters, and it is insufficient to evaluate only whether the urban core district, in isolation, has been able to achieve a desirable degree of either horizontal or vertical (tilt) equity. As such, the analyses herein include elementary schools in all other districts sharing the same Core Based Statistical Area as the urban core districts under investigation.

Figure 1
Contextual constraints on within-district resource allocation



Finally, this study adds to the current body of literature by estimating *additional cost* benchmarks for the relative progressiveness in per pupil spending that should exist across non-rural elementary schools in major metropolitan areas in Texas. Prior studies, such as those using a weighted student index, simply assume that weights selected through policy deliberation represent additional costs. Drawing on a large body of literature on district level cost function modeling, we estimate school level cost models for elementary schools within metropolitan areas, with the objective of identifying the additional costs of constant outcomes associated with variation in school level poverty rates. We then use these additional cost estimates to project the differences in spending associated with current average outcomes across all elementary schools in each labor market. We use these cost projections to evaluate the relative position of urban elementary schools in their labor market contexts.[2]

2.0 Data and Methods

The present study uses a 3-year panel, from 2005 to 2007, for Texas elementary schools in the Houston, Dallas, Austin and San Antonio Core Based Statistical Areas. Large city districts under investigation include Houston,[3] Dallas, Ft. Worth, San Antonio and Austin. Indeed longer panels of data are available on school level expenditures and student demographics, as those used by Ajwad (2006) and by Roza and colleagues (2007). However, this study differs from those earlier works in that this study includes (a) more in-depth analysis of teacher qualifications,

[2] We acknowledge that there exists some debate over the usefulness of expenditure function regression modeling, holding outcomes constant, for estimating absolute or additional "costs" of achieving outcomes, so-to-speak (see Costrell, Hanushek and Loeb, 2007). However we believe this method still adds useful information to the discussion herein because we begin by characterizing how spending varies across schools within districts and within metro areas at varied outcome levels, finding that on average in the metro areas under investigation, the highest poverty schools spend about 25% more than the lowest poverty schools, at varied outcome levels. Our primary use of the expenditure/cost function herein is to estimate that same differential holding outcomes constant. We argue that it is useful for purposes herein to understand how expenditures vary at constant outcomes, whether we accept those expenditures to be representative of true "cost" predictions or not. We find herein that at constant outcomes, the difference between spending in the lowest and highest poverty schools is greater than the 25% actual differential, and somewhere between 44% and 50%. Downes (2004) notes, "Given the econometric advances of the last decade, the cost-function approach is the most likely to give accurate estimates of the within-state variation in the spending needed to attain the state's chosen standard, if the data are available and of a high quality" (p. 9).

[3] Houston data are partially influenced by the effects of Hurricane Katrina which caused significant enrollment changes in early 2005 (See Imberman, Kugler and Sacerdote, 2009). However, it would appear that year to year stability of school level enrollments in Houston schools from 2005 to 2007 do not differ dramatically from schools in other large Texas cities such as Dallas (maximum and minimum school level changes greater in Dallas than Houston, perhaps due to school reorganization). Further, the most dramatic changes to enrollments occurred in a cluster of schools in the western portions of the district. Enrollment, financial and outcome changes in these particular schools do not appear to have substantial influence on the models estimated herein.

including shares of teachers who failed state certification exams (pedagogy exams), and (b) cost models which require consistent outcome measures over time. The major limiting factor for this study was the state assessment system from which outcome measures are drawn, which was overhauled in 2004. As such, consistent cost models could be estimated either through 2004, or from 2005 to 2007. We opted for the more recent period.

Like Ajwad (2006), the present study uses only elementary schools in Texas. It is important to separate schools by the grade level of students served because of assumed differences in expenditure levels by grade level and likely differences in poverty measurement by grade level. On average, elementary schools show higher poverty levels, and on average, high schools spend more per pupil. Including schools of different grade levels without covariates for grade level might lead one to find that lower poverty schools spend more than higher poverty ones. Covariates may be included for grade level, but grade level variations in funding may dominate other variations. Perhaps most importantly, the sample size of elementary schools is sufficient for expenditure regressions and subsequent cost models, whereas within district sample sizes for middle and secondary schools typically are not.

The sample includes approximately 1,409 elementary schools per year within four major metropolitan areas and excludes schools with National Center for Education Statistics locale codes for "rural" schools. The majority of data were acquired through the Texas Education Agency's Academic Excellence Indicator System (AEIS) data download site (http://www.tea.state.tx.us/perfreport/aeis/2007/DownloadData.html) Additional data were drawn from the National Center for Education Statistics, Common Core of Data, Public School Universe and from U.S. Census (2000).

Two versions of the school site expenditure measure were used. First, total current operating expenditures per pupil were used.[4] Alternatively, current operating expenditures on special education programs were removed in an effort to decompose variations in resources across schools.[5] Student population characteristics included the percent of students in special education programs, the percent of students qualifying for free or reduced lunch, and the percent of students with limited English language proficiency.

Three school aggregate teacher measures were used: 1) pupil to teacher ratios, a teacher quantity measure, 2) the percent of teachers in their first three years in the profession (% novice), a teacher quality proxy, and 3) the percent of teachers who had failed the state certification exam one or more times.[6] Finally, for our cost models, we use a measure of the percent of children across third and fourth grades scoring proficient or higher on the Texas Assessment of Knowledge and Skills (TAKS).

Decomposing Expenditure Patterns

Our expenditure regression evaluating the cost sensitivity of spending variation across schools is expressed:

$$\mathbf{Expend_s = f(Size_s , Disability_s, LEP_s , Poverty_s)}$$

Where spending per pupil is expected to vary as a function of differences in the percent of children with disabilities across schools and differences in the percent of children qualifying for

[4] This figure excludes central administrative and district transportation costs, and includes all other school site expenditures. Detailed explanation can be found at: http://ritter.tea.state.tx.us/perfreport/aeis/2008/glossary.html

[5] Special education expenditures removed include the "additional expenditures" above and beyond regular education spending that were allocated to serve special education students. Special education students remain included in pupil counts because these students also make use of regular education resources.

[6] These measure were computed at the campus level using data from the Texas statewide staffing files, and provided by Ed Fuller, Assistant Research Professor at the University of Texas at Austin.

subsidized lunch (free or reduced) under the National School Lunch Program and percentages of children with Limited English Language Proficiency (LEP). We also include two school size categorical variables, because spending per pupil is often a significant function of economies of scale. Reviews of economies of scale in education suggest an optimal elementary school size between 300 and 500 students (Andrews, Duncombe and Yinger, 2002).

We estimate three versions of the expenditure regressions in order to decompose, stepwise the relationship between cost factors and expenditure variation. First, we estimate the full model, including scale, disability and poverty variation in relation to all current expenditures per pupil. Next, we remove from our current expenditure measure, additional expenditures on special education. Finally, we remove from the sample of schools, all schools with fewer than 300 students to remove variation associated with small size.

Evaluating Teacher Quantity/Quality Variation

To evaluate the distribution of staffing across students in schools we first ask whether additional quantities of staff have been allocated to schools with more needy children – poor children, children with limited English proficiency and children with disabilities. One would expect that to provide for equal educational opportunity across varied school settings within a district, one would need to allocate greater quantities of teachers – of at least comparable qualifications – to schools with greater concentrations of higher need children.

To evaluate the distribution of teacher quantities, we estimate regression models using pupil to teacher ratios as the dependent variable. We estimate models of pupil to teacher ratio as a function of school size, poverty, limited English proficiency and student disability rates.

$$\mathbf{TQuant} = f(\mathbf{Size}_s\text{ , }\mathbf{Disability}_s\text{, }\mathbf{LEP}_s\text{ , }\mathbf{Poverty}_s)$$

The expectation in these models is that teacher quantities will be predictable as a function of poverty rates and disability shares, with lower pupil to teacher ratios in schools with higher shares of children qualifying for free or reduced lunch and children with disabilities.

Next, we evaluate the whether equity in teacher quality measures exists across schools. For our two teacher quality measures we select the percent of teachers in a school who are novice teachers (<4 years experience) and the percent of teachers who failed the state pedagogy exam for certification one or more times. Author (in press) have found each of these measures to be associated with school level performance outcomes in Texas schools and Hanushek and Rivken (2007) raise specific concerns regarding the distribution of inexperienced teachers across black and white schools in Texas, noting specifically the extent to which differences across schools in teaching quality influence growth in the black-white achievement gap from grade 3 to grade 8.

As with our teacher quantity measures, we model each teacher quality measure as a function of school size, poverty, limited English proficiency and student disability rates.

$$\mathbf{TQual} = f(\mathbf{Size_s}, \mathbf{Disability_s}, \mathbf{LEP_s}, \mathbf{Poverty_s})$$

In this case the expectation is that the variations in teacher quality should not (but likely will) be predictable as a function of student population characteristics, or at least that we should not find higher shares of novice teachers and higher shares of teachers who failed certification exams in higher poverty, higher minority schools.

Isolating and Modeling the Poverty Component

Returning to our school level expenditure models, one of our objectives is to identify the slopes and intercepts of per pupil spending with respect to poverty across schools within our large urban districts and across schools in their surrounding labor market. In short, the goal is to estimate the actual conditions in our districts and labor markets as they relate back to Figure 1, comparing the tilt (slope) and overall level (intercept and/or mean) of expenditures with respect to poverty. To project and plot these relationships, we estimate an expenditure regression excluding small elementary schools, including all schools in each core based statistical area and interacting our poverty term (free/reduced lunch) with a dummy variable for schools in the large urban district (or two urban districts in the Dallas CBSA).

$$\ln(\text{expend}) = f(\text{Pov} \times \text{District})$$

Models are independently estimated for each core based statistical area, and could be expanded by similar method to include the entire state. Herein, our objective is primarily illustrative – to determine whether elementary schools as a group, in any of our urban districts under investigation, are a sinking ship – having per pupil expenditures too low on average to redistribute from lower to higher need schools.

Estimating a School Level Expenditure Model at Constant Outcomes (Cost Model)

For our cost models, the goal is to capture existing relationships between spending variation across schools and outcome variation across schools in order to determine how much more or less spending is associated with achieving average educational outcomes across different schools serving different student populations. The goal is to estimate a global model of these relationships for the elementary schools in our sample. To capture the input-outcome relationship our samples of schools must include sufficient variation in both inputs and outcomes. As such, we include in these models elementary schools both in the urban core and in neighboring districts in the same Core Based Statistical Area. Our modified spending, or *Cost* function model may be expressed as:

$$\mathbf{Expend_s = \mathit{f}(Outcomes_s\ , Size_s\ , Disability_s\ , Poverty_s\ , CBSA, Inefficiency)}$$

Where again, spending per pupil is in the position of the dependent variable. As with the previous expenditure regressions herein, the objective is to discern how spending per pupil varies across schools as a function of school size and variation in disability shares, poverty shares and children with limited English language proficiency. We also include a dummy variable for each Core Based Statistical Area to account for average variation in labor costs and other potential unmeasured differences across labor markets within Texas. In alternative models (see Appendix A), we tested inclusion of a 2004 Teacher Fixed Effects district level wage index to capture wage variation between districts within metropolitan areas. This index was developed by Taylor (2004) and also applied in Texas district level cost modeling by Imazeki and Reschovsky (2004). But this indicator proved generally not statistically significant in our cost models and led to some erosion of diagnostic statistics. Perhaps most importantly, including these factors did not substantively alter the elasticities between spending levels and other cost factors.

In the “cost” model, we include a measure of the percent of children scoring proficient or higher on state assessments. That is, we attempt to evaluate how spending varies across schools in relation to school size and student population characteristics, at constant outcome levels. The goal is to discern how much more or less is spent, on average, to achieve specific outcomes. Alternatively, we estimated models using TAKS scale scores. Like the fixed effects district level wage index, while the use of scale scores seemed potentially more appropriate, models using scale scores did not perform as well statistically as those including passing rates. We report the alternative estimates herein.

The cost function approach used herein requires that we address two concerns – 1) how might we control for the fact that some schools or districts on average spend more than necessary to achieve specific outcomes, or how do we account for potential spending inefficiency? And 2) is it possible that our outcome measure, used as an independent variable, is partly a function of our dependent variable, spending, and also related to other independent variables in the model? That is, the outcome measure is endogenous.

An extensive body of district level cost function research has applied instrumental variables modeling to account for endogeneity of outcomes while simultaneously attempting to control for variations in efficiency across districts (Duncombe and Yinger, 2008, 2007a, 2007b, 2006, 2005, 2000, 1999, 1998, 1997; Imazeki and Reschovsky, 2004). We apply a similar approach herein, but with school level data. First, we apply instrumental variables regression where the outcome measure – TAKS passing rates – is treated as endogenous, requiring identification of an appropriate set of exogenous instruments discussed below. Second, we identify a set of measures associated with variations in spending across schools which are variations otherwise unassociated with outcome variation. That is, indirect controls for efficiency, which in this context are simply an attempt to address omitted variables bias. Modeled without these indirect controls for efficiency, we would have a model of spending as a function of an outcome measure and factors associated with the costs of producing that outcome. But, our spending measure likely varies across schools within our core based statistical areas as a function of more than just cost factors and desired outcomes. Spending variation neither associated with outcomes or costs may be considered inefficiency (at least with respect to producing the measured outcomes). For example, spending may vary as a function of differences in the *fiscal capacity* across districts and some of that variation may not yield outcome differences. One explanation might be that *public monitoring* of the link between increased spending and outcomes is stronger in some communities than in others.

We test a variety of district level factors to explain spending differences across our schools unassociated with outcome differences and generally not considered to be cost factors. Our final models include (a) a measure intended to capture the overall efficiency of organization of schools within each district - the average enrollment per school by district and (b) a monopoly (reduced competition) measure for each district - the ratio of the district's own student population to the total student population of the CBSA.[7]

When treating outcomes as endogenous, we must find a set of exogenous instruments that may be used in generating predicted values of our outcome measure in the first stage regression equation. Those instruments should be sufficiently related to the outcome measure, but not related to our spending measure. In district level cost models, Duncombe and Yinger (2007a, 2006) draw on characteristics of other school districts sharing labor markets and/or legislative districts, testing measures of both average characteristics of proximal districts and ratios of differences between the observation and proximal districts. The conceptual basis for these instruments is that the competitive environment in which a school or district exists, may exert pressure on the district or school's own performance outcomes.

Our final models include two instruments (a) the mean percent black students among all other (excl. observation) elementary schools in the same district and (b) the ratio of the elementary school aged population in the district to the adult population of the district (from

[7] Both measures should aid in sorting out district average differences in efficiency across schools in the same CBSA, but admittedly do little to shed light on differences in relative efficiency across schools within districts. This shortcoming, however, is less problematic than it may seem, given our use of the cost function findings herein, which is not to predict individual school level costs of specific outcome targets. Our goal is to use the cost function to derive the average cost response to poverty variation across schools across all districts in the sample, where poverty variation within districts is generally much less than poverty variation across the districts in the model. As such, correcting for between district variations in efficiency should protect against significant overstatement or understatement of additional costs with respect to poverty.

Census 2000). Our reasoning behind choosing the racial composition measure is that racial composition, especially percent black population in Texas districts, may alter the local competitive landscape. The simultaneous influence of school level black student concentration and teacher sorting on student outcomes is addressed by Hanushek and Rivken (2007). Due to racial achievement gaps that emerge between grades 3 and 8 in Texas schools, schools in a competitive environment having more black students may actually face reduced competition to improve outcomes - all else equal. We apply conventional statistical tests to evaluate instrument relevance (F-statistic on instruments) and over-identification (Hansen J, p-value), as discussed in Bound, Jaeger and Baker (1995) to evaluate our instruments.

Finally, we note that our use of this "cost" modeling method herein is merely to capture the differences in spending across schools by poverty associated with constant, current average assessment outcomes. Other expenditure regressions estimated in this study which do not include outcome measures also estimate the differences in spending with respect to poverty, but at widely varied educational outcomes, where those outcomes are systematically lower in higher poverty schools. Whether interpreted as "cost" estimates or not, we argue that it is useful to correct the effects of poverty on spending for outcome levels to better understand where higher poverty schools should fall, to achieve more equal educational opportunity with respect to lower poverty schools in the same metropolitan area, assuming current production technologies.

3.0 Findings

Our findings are organized in four sections beginning with a description of the competitive position of each urban district in its labor market, and concluding with cost adjusted analysis of within and between district elementary school expenditures.

3.1 How do aggregate resource levels and teacher characteristics of urban core districts compare with their surroundings?

Table 1 displays the descriptive statistics on the five urban core districts under investigation herein. Numbers of elementary schools within districts ranges from 54 to 140, and total enrollments in those schools range from 27,000 to 86,000. In each case the share of children in the district that qualify for free or reduced price lunch is higher than the share in all other elementary schools not in the district. That differential is smallest for Fort Worth which shares a core based statistical area with Dallas. In addition, the percent of students who are Hispanic is also higher in the urban core elementary schools, and in all but San Antonio, the percent of students who are black is higher in the urban core elementary schools.

Current operating expenditures per pupil are higher in the urban core district than in all others in the same CBSA in Austin, Fort Worth and Houston, approximately equal in San Antonio and significantly lower in Dallas. The relatively low position of Dallas accounts somewhat for the relatively higher position of Fort Worth, providing an intriguing contrast among districts sharing a metropolitan area. In addition, variation in per pupil operating expenditures is greatest in Dallas and is greater than variation across the Dallas/Fort Worth CBSA. In Austin, within district variation is comparable to variation across the CBSA and in the other three cities, within district variation is less than variation across the CBSA.

When special education expenditures are excluded, per pupil spending is higher in each urban core district, relative to others in the CBSA, except for Dallas. Patterns of variation remain similar. However, we note at this point that the variation observed may include variation legitimately associated with cost variation.

Table 1
Characteristics of Urban Core and other districts sharing CBSA (2007)

City	**Austin**	**Dallas**	**Ft. Worth**	**Houston**	**San Antonio**
Elem in District [1]	56	110	62	140	54
Students (2007)	34,016	70,834	34,503	86,155	27,167
Elem in CBSA (excl. dist)	67	481	529	343	158
Students (2007)	45,743	288,990	325,321	262,107	100,308
Demographics					
% Free/Reduced					
District	82%	91%	82%	85%	92%
CBSA (excl. dist)	46%	55%	60%	58%	64%
% Black					
District	14%	26%	28%	29%	6%
CBSA (excl. dist)	11%	18%	18%	19%	8%
% Hispanic					
District	71%	69%	60%	62%	91%
CBSA (excl. dist)	43%	39%	43%	45%	65%
Mean Spending (Including SE)					
In District	$6,232	$4,840	$5,775	$5,896	$5,825
Coefficient of Variation	15%	19%	11%	11%	11%
In CBSA	$5,023	$5,546	$5,368	$5,294	$5,857
Coefficient of Variation	14%	14%	16%	13%	14%
Mean Spending (Excluding SE)					
In District	$5,082	$4,531	$5,288	$5,192	$5,057
Coefficient of Variation	13%	20%	12%	10%	9%
In CBSA	$4,138	$4,739	$4,636	$4,559	$4,838
Coefficient of Variation	11%	14%	15%	13%	13%

Figure 2 summarizes the relative per pupil operating expenditures for schools within the urban core districts and in their surrounding metropolitan areas by grade level of school. Elementary, Middle and Secondary schools in Houston, San Antonio and in Austin outspend schools of same grade level in surrounding districts. The same is true for Fort Worth.

But, Dallas elementary schools lag behind elementary schools in neighboring districts on current operating expenditures. Dallas high schools also lag behind, but Dallas middle schools spend more than middle schools in surrounding districts.

Figure 2
Current Operating Spending per Pupil in Urban Core and Surrounding Districts by Grade Level

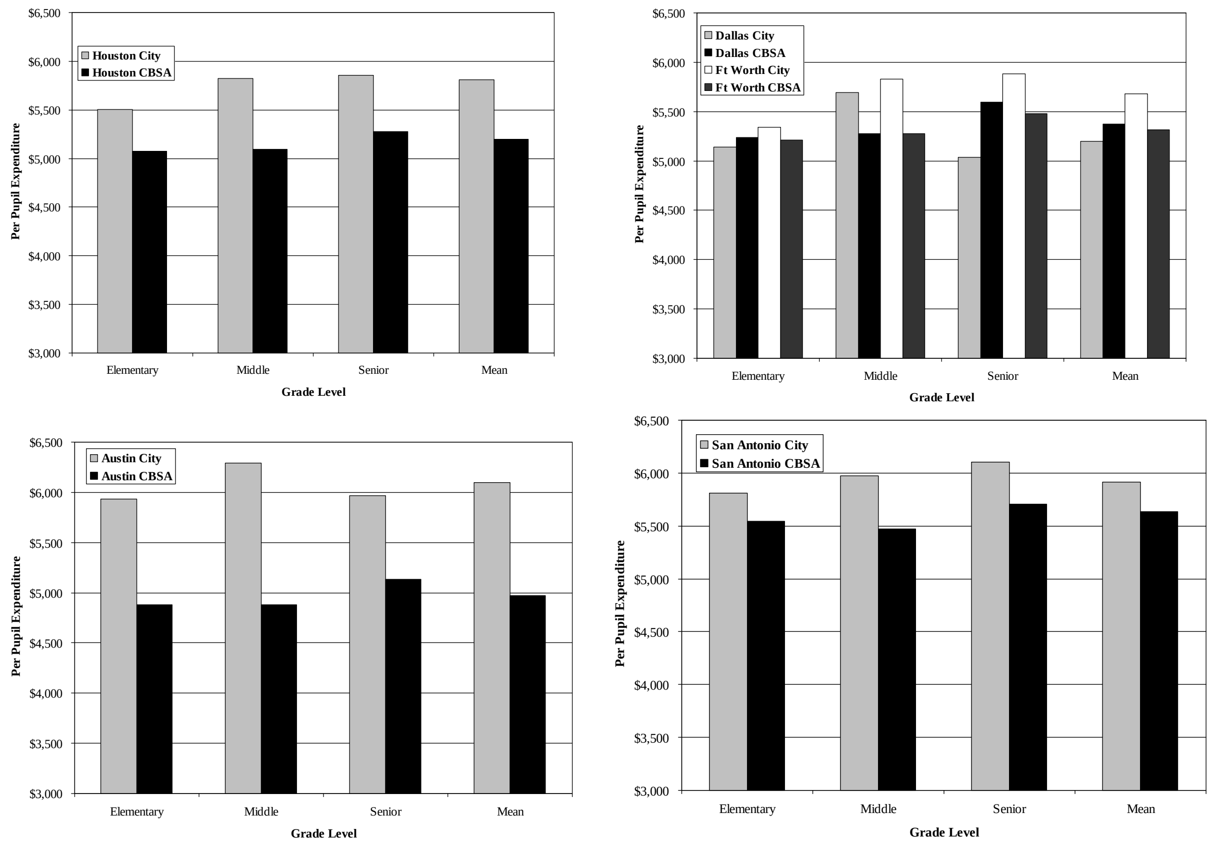
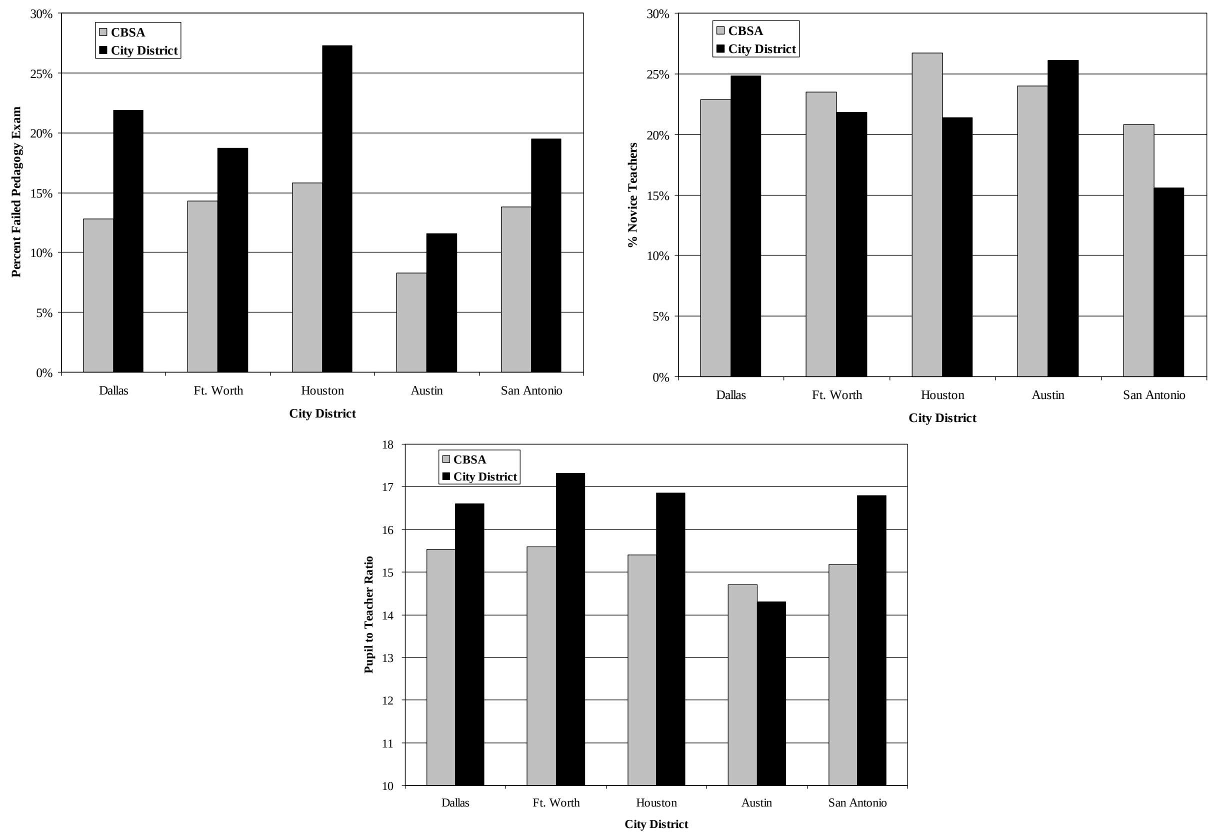


Figure 3 summarizes teacher characteristics for the urban core districts and their surrounding labor market. All of the urban core districts, but especially Houston have much higher levels of teachers who have failed the state certification exam. Dallas and Austin have higher rates of novice teachers than surrounding districts, while the other cities have lower rates than surrounding districts. All but Austin have higher pupil to teacher ratios than surrounding districts, indicating that Austin may have traded off, to some extent teacher experience for teacher quantity.

Figure 3
Teacher Characteristics in Urban Core and Surrounding Districts (Elementary Schools)



3.2 How do fiscal resources and teacher characteristics vary across schools within large urban districts?

Table 2 presents the decomposition of variation in current expenditures per pupil with respect to major cost factors. The first columns present the model of total current expenditures per pupil with respect to disability rates, poverty rates, LEP rates and two small school enrollment categories. In all five cities, smaller schools show elevated per pupil spending. But, as noted previously, one might argue that such higher cost small schools need not exist within population dense large urban school districts. The elevated spending in smaller schools comes at the expense of other students attending larger schools (just as the elevated spending on middle schools comes at the expense of spending on elementary and secondary schools in Dallas). In all but Dallas, per pupil spending is sensitive to variations in the percent of children with disabilities. In each case the elasticity is relatively large. Specifically, the elasticity between disability concentration and spending is much larger than the elasticity between poverty and spending.

In Austin, Houston and Fort Worth, the elasticity between spending and poverty rate is positive and significant, and larger in Fort Worth and Austin. Considering all of these factors, per pupil spending variation is least predictable in Houston and Dallas, the difference between the two, being that Dallas has a large amount of unexplainable variation and Houston a smaller amount of relatively unexplainable variation.

The second set of models retains the small schools and related dummy variables, but excludes expenditures on special education programs. When limited to scale and poverty related variation, spending per pupil remains least predictable in Houston. In Fort Worth and Austin, spending per pupil is most sensitive to poverty variation, and in Houston, spending per pupil remains sensitive to poverty variation, but less so. In Dallas and San Antonio, spending is not sensitive to poverty variation.

The final set of models excludes the smallest schools and drops the school size dummy variables in an effort to isolate poverty related variation in spending. When excluding special education spending and small school spending, variation in spending per pupil is a positive predictable function of poverty variation in Dallas, Fort Worth and Austin, less so in Houston (less than 10% of variance in spending explained by poverty variation), and marginally significant ($p<.10$) in San Antonio. This finding is somewhat surprising because Houston is the one, among these cities, that has been frequently applauded for its implementation of a rational, need-oriented weighted student funding formula.

Table 2

Models of Current Spending and Teacher Characteristics in Texas Cities

	Current Expenditure Models									Teacher Characteristics Models								
	Total Current Operating Expend.			Excludes Special Education			Scale Efficient Only			Failed Pedagogy Exam			% Novice Teachers			Pupil to Teacher Ratio		
	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Dallas																		
% Disability	0.270	0.535		-0.907	0.558		-0.636	0.395		-1.014	0.249	*	0.109	0.278		-14.553	4.743	*
% At Risk	0.190	0.200		0.201	0.216		0.344	0.141	*	0.341	0.073	*	0.184	0.061	*	-1.595	1.199	
% LEP/ELL	-0.341	0.068	*	-0.360	0.073	*	-0.333	0.080	*	-0.118	0.043	*	0.259	0.039	*	1.849	0.936	**
Enroll 100 to 300	0.332	0.090	*	0.376	0.087	*				0.056	0.032	**	-0.013	0.021		-4.474	0.547	*
Enroll 300 to 500	0.200	0.039	*	0.195	0.041	*				0.053	0.019	*	-0.009	0.016		-2.213	0.297	*
Year = 2006	0.036	0.010	*	0.032	0.010	*	0.024	0.010	*	0.008	0.007		-0.017	0.009	**	0.386	0.112	*
Year = 2007	-0.026	0.011	*	-0.027	0.012	*	-0.022	0.012	**	0.018	0.010	**	0.004	0.013		-0.359	0.167	*
Constant	8.414	0.207	*	8.425	0.223	*	8.268	0.118	*	0.012	0.065		-0.024	0.055		18.371	1.091	*
R-Squared	0.463			0.405			0.190			0.196			0.269			0.431		
Fort Worth																		
% Disability	0.688	0.309	*	-0.551	0.391		-0.239	0.413		0.468	0.642		-1.019	0.473	*	-17.458	4.469	*
% At Risk	0.303	0.052	*	0.390	0.065	*	0.505	0.115	*	0.371	0.065	*	0.179	0.080	*	-2.548	0.667	*
% LEP/ELL	-0.065	0.046		-0.081	0.049		-0.101	0.067		-0.124	0.079		-0.086	0.065		0.437	0.675	
Enroll 100 to 300	0.255	0.041	*	0.261	0.043	*				-0.065	0.037	**	-0.041	0.062		-2.664	0.636	*
Enroll 300 to 500	0.109	0.015	*	0.112	0.017	*				-0.024	0.026		0.017	0.021		-0.989	0.201	*
Year = 2006	-0.012	0.008		-0.023	0.008	*	-0.032	0.010	*	0.005	0.009		-0.029	0.010	*	0.370	0.124	*
Year = 2007	0.040	0.011	*	0.030	0.011	*	0.008	0.012		0.001	0.010		-0.019	0.013		0.158	0.199	
Constant	8.318	0.041	*	8.262	0.058	*	8.164	0.088	*	-0.096	0.063		0.184	0.070	*	20.562	0.553	*
R-Squared	0.568			0.596			0.425			0.204			0.125			0.332		
Houston																		
% Disability	1.238	0.223	*	-0.432	0.291		-0.342	0.285		0.305	0.360		-0.642	0.316	*	-15.573	4.168	*
% At Risk	0.118	0.042	*	0.090	0.041	*	0.122	0.041	*	0.409	0.044	*	0.106	0.048	*	0.001	0.795	
% LEP/ELL	-0.013	0.033		0.006	0.031		-0.023	0.033		-0.106	0.052	**	0.003	0.049		-0.203	0.557	
Enroll 100 to 300	0.157	0.021	*	0.157	0.024	*				-0.023	0.055		0.004	0.052		-2.034	0.579	*
Enroll 300 to 500	0.108	0.015	*	0.090	0.014	*				-0.010	0.024		0.010	0.024		-0.043	0.318	
Year = 2006	0.021	0.005	*	0.012	0.005	*	0.022	0.005	*	0.009	0.006		-0.023	0.007	*	-0.076	0.112	
Year = 2007	0.053	0.007	*	0.037	0.007	*	0.043	0.007	*	0.015	0.008	**	-0.022	0.010	*	-0.150	0.207	
Constant	8.413	0.036	*	8.454	0.044	*	8.427	0.044	*	-0.071	0.040	**	0.189	0.041	*	18.241	0.690	*
R-Squared	0.487			0.289			0.146			0.245			0.051			0.082		
Austin																		
% Disability	1.513	0.272	*	-0.470	0.267	**	-0.513	0.519		-0.611	0.218	*	-0.429	0.354		-15.050	2.288	*
% At Risk	0.299	0.074	*	0.407	0.085	*	0.338	0.094	*	0.251	0.056	*	0.267	0.076	*	-1.897	0.687	*
% LEP/ELL	-0.123	0.102		-0.179	0.103	**	-0.080	0.121		-0.151	0.068	*	0.104	0.096		0.752	0.818	
Enroll 100 to 300	0.245	0.031	*	0.297	0.040	*				0.006	0.020		0.001	0.036		-2.582	0.263	*
Enroll 300 to 500	0.115	0.027	*	0.132	0.026	*				-0.026	0.019		0.012	0.022		-1.470	0.262	*
Year = 2006	-0.017	0.012		-0.019	0.011	**	-0.019	0.011	**	0.017	0.006	*	0.005	0.008		0.077	0.138	
Year = 2007	0.040	0.016	*	-0.012	0.015		-0.011	0.020		-0.003	0.009		-0.020	0.016		-0.441	0.158	*
Constant	8.349	0.045	*	8.292	0.045	*	8.311	0.066	*	0.034	0.030		0.053	0.040		17.419	0.414	*
R-Squared	0.656			0.643			0.351			0.293			0.445			0.692		
San Antonio																		
% Disability	1.572	0.305	*	-0.016	0.260		-0.142	0.256		0.597	0.535		-0.320	0.416		-15.085	4.173	*
% At Risk	-0.147	0.137		-0.077	0.122		0.213	0.118	**	0.074	0.204		0.173	0.126		0.935	1.979	
% LEP/ELL	0.149	0.050	*	0.217	0.056	*	0.149	0.059	*	0.156	0.114		-0.136	0.073	**	-1.995	0.814	*
Enroll 100 to 300	0.256	0.029	*	0.227	0.021	*				-0.042	0.048		-0.007	0.030		-2.168	0.409	*
Enroll 300 to 500	0.109	0.016	*	0.102	0.015	*				0.036	0.028		-0.002	0.018		-1.088	0.216	*
Year = 2006	0.028	0.009	*	0.033	0.009	*	0.030	0.009	*	-0.017	0.010		0.019	0.011	**	0.299	0.166	**
Year = 2007	0.009	0.009		0.022	0.009	*	0.016	0.010		-0.017	0.011		0.031	0.014	*	0.029	0.204	
Constant	8.571	0.133	*	8.487	0.117	*	8.249	0.111	*	0.036	0.206		0.043	0.121		18.062	1.948	*
R-Squared	0.663			0.611			0.268			0.110			0.054			0.371		

*p<.05, **p<.10

Table 2 also evaluates teacher quantity/quality tradeoffs within districts. In a fully flexible environment, schools within districts or districts themselves would have latitude to use existing resources to either hire more teachers or pay teachers more in higher poverty schools within the district. The latter option - differential pay - is generally less available than the former. As such, in the present case, the assumption is that where resource levels are higher in higher poverty schools, those resources are most likely leveraged toward increasing teacher quantity. However, we are also interested in whether districts have been able to leverage resources to increase teacher quantity, while holding constant (or at least random with respect to poverty), teacher quality measures. Fort Worth and Austin, the two districts with significantly higher resource levels in higher poverty schools, appear to have leveraged those resources to increase teacher quantities in higher poverty schools by reducing pupil to teacher ratios. Recall also that Austin was the only among these city school districts to have lower average pupil to teacher ratios than surrounding districts. In all cities, higher rates of children with disabilities are associated with reduced pupil to teacher ratios, as one might expect, given the increased staffing needs associated with children with disabilities.

The tradeoff for Austin, in having lower pupil to teacher ratios than surrounding areas and having a "progressive" distribution of those teachers, appears to come in the percent of teachers who are in their first three years of teaching. Austin has a higher percent overall than surrounding districts and those teachers are concentrated in higher poverty schools in Austin. Austin is not alone, however, in that Dallas, Ft. Worth and Houston also display statistically significant disparities in the distribution of novice teachers with respect to school poverty rates.

When it comes to shares of teachers who failed the state pedagogy exam, Dallas, Ft. Worth, Houston and Austin all display internal disparities with respect to poverty, with the elasticity between poverty and pedagogy exam failure rates being largest in Houston. Recall also that Houston had the highest share of teachers who had failed the pedagogy exam, and the largest differential between itself and surrounding districts (Figure 3). Austin had the lowest percentage and smallest differential with surrounding districts.

3.3 How does need and cost related variation within large urban districts fit within the broader labor market of resource variation among schools in surrounding districts?

Taking the reduced expenditure regressions above and interacting the poverty term with a dummy variable for the large city school districts allows us to project the slopes in Figure 4, in order to provide an illustrative view of school site budgets which relates to our hypothetical posed in Figure 1. In the Dallas core based statistical area, an elementary school with 100% children qualifying for free or reduced lunch spends approximately $5,000 per pupil and an elementary school with approximately 0% free/reduced lunch spends approximately $4,000 per pupil – or an average implicit weight for non-Dallas and non-Ft. Worth schools, of 25%. Dallas schools range from just over 20% free or reduced lunch to 100%. While the low poverty Dallas school falls on the trendline for the CBSA, higher poverty Dallas schools fall well below that trendline, at just over $4,500 per pupil – non-competitive in their labor market context. Ft. Worth schools have more progressively distributed funding than their surrounding environment. Ft. Worth's highest poverty schools have projected higher expenditures per pupil than surrounding schools, but this redistribution comes at the expense of maintaining competitive spending for Ft. Worth's lower poverty schools.

For Austin, the slope between poverty and spending within the district is comparable to the slope for schools in surrounding districts, but on average Austin retains a healthy competitive financial advantage across all levels of poverty. While Houston schools also maintain a financial advantage over those in surrounding districts, Houston ISD has chosen to distribute that advantage to lower poverty schools. Houston's lowest poverty schools are funded more highly than low poverty schools in surrounding districts and Houston's higher poverty schools are funded only comparable to high poverty schools in surrounding districts. Again, expenditures represented in Figure 4 are projected based on slopes with respect to poverty, where in Houston, for example, that slope explained little overall variation.

San Antonio has no particularly low poverty schools. San Antonio elementary schools like Dallas elementary schools generally fall below those in surrounding districts, but in San Antonio expenditures are more progressively distributed across the relatively narrow range of poverty in San Antonio elementary schools.

Figure 4
Predicted spending by poverty for scale-efficient elementary schools

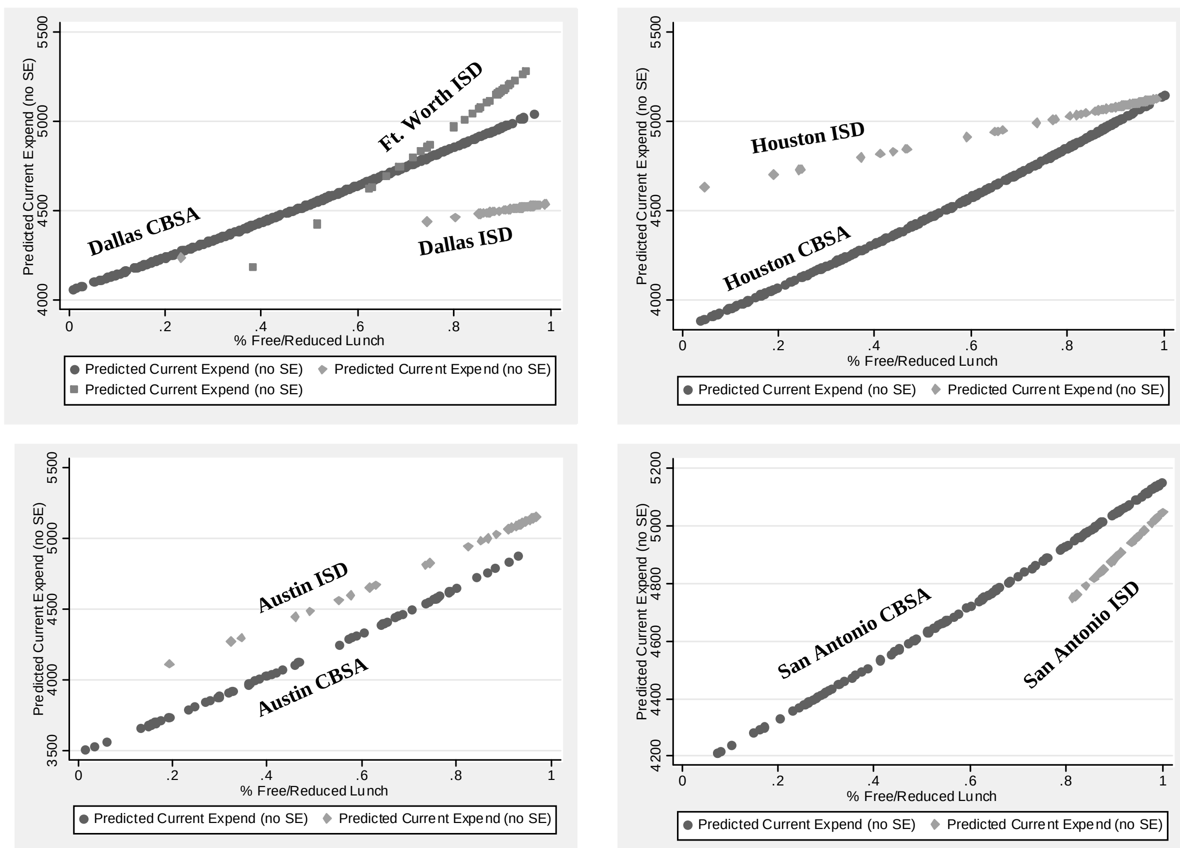
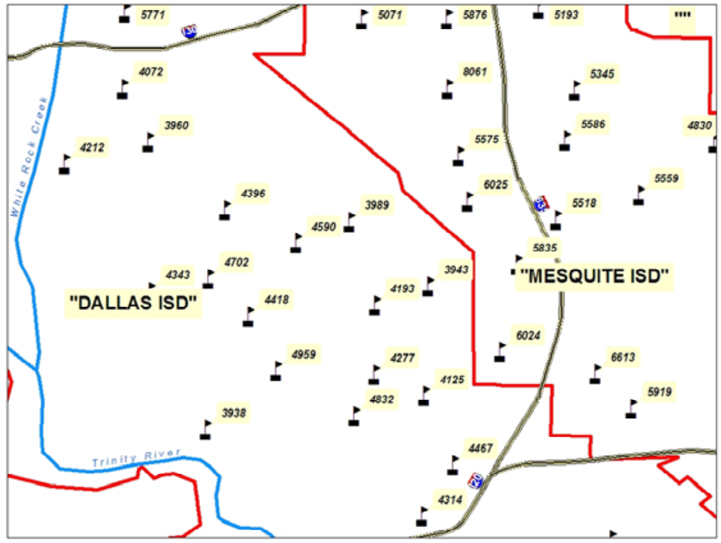


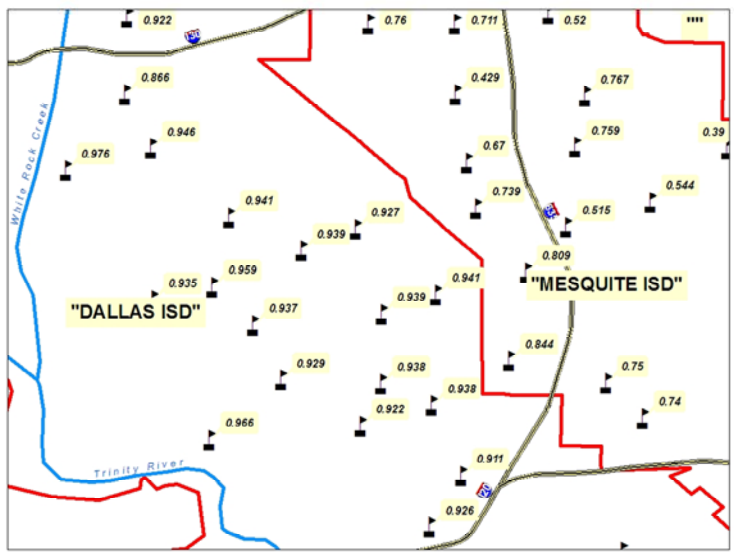
Figure 5 provides a geographic portrayal of the Dallas scenario, with the upper panel showing per pupil expenditures of Dallas elementary schools and the lower panel showing poverty rates for the Dallas schools. The panels of the figure represent the Southeastern corner of the district which abuts Mesquite ISD, with no major natural or man-made barriers between the two (several Mesquite schools lie on the Western side of the interstate). Rather, there are a multitude of cross streets connecting the neighborhoods between Mesquite and this section of Dallas ISD. There is little geographically in Figure 5 that might alter a teacher's job choice, with the possible exception of having grown up in one district versus the other. But, on average the Mesquite schools have much higher spending levels and marginally lower poverty levels than these Dallas schools. For Dallas, these are schools of slightly greater than average poverty. It would likely be difficult to shift even more resources away from these schools into even higher poverty Dallas schools elsewhere in the district. Similarly, it may be difficult to shift more resources to these schools from elsewhere in the district.

Figure 5
Proximity of City Elementary Schools to Neighbors (Dallas City and CBSA)

Dallas & Mesquite ISD Per Pupil Spending (elementary schools)



Dallas & Mesquite ISD % Free/Reduced Lunch (elementary schools)



3.4 To what extent does existing variation in resources account for the additional costs of providing equal educational opportunity across schools within large urban districts and between large urban districts and their surroundings?

Table 3 presents the cost function models of Texas elementary schools.[8] We find that higher spending levels are associated with higher proficiency rates, all else equal. Further, at constant proficiency, higher rates of children with disabilities and higher rates of children in poverty are associated with higher spending. Excluding special education spending, spending per pupil is lower in the Austin CBSA, but otherwise, there are no differences in CBSA level spending compared to Houston (baseline). By 2007, spending had edged up slightly relative to 2005

[8] Additional cost models including Taylor (2004) Teacher Fixed Effect index and LEP variable are in Appendix A.

Table 3
Cost model estimates

	% Proficient (Grades 3 & 4)						Mean Scale Score Grades 3 to 6					
	Includes Special Education			**Excludes Special Education**			**Includes Special Education**			**Excludes Special Education**		
	Coef.	*Std. Err.*	*P>z*	*Coef.*	*Std. Err.*	*P>z*	*Coef.*	*Std. Err.*	*P>z*	*Coef.*	*Std. Err.*	*P>z*
Potential Cost Factors												
Student Outcomes	0.589	0.243	*	0.351	0.191	**	2.670	1.535	**	1.709	1.397	
% Disability	1.346	0.150	*				1.571	0.118	*			
% Free/Reduced	**0.347**	**0.086**	*	**0.323**	**0.069**	*	**0.381**	**0.146**	*	**0.350**	**0.133**	*
% LEP	-0.034	0.038		0.005	0.029		-0.002	0.038		0.009	0.034	
Enroll 100 to 300	0.197	0.033	*	0.203	0.033	*	0.205	0.030	*	0.208	0.033	*
Enroll 300 to 500	0.129	0.009	*	0.116	0.008	*	0.130	0.009	*	0.117	0.009	*
District Mean Efficiency Factors												
District Students per School	0.033	0.019	**	0.011	0.018		0.059	0.024	**	0.017	0.023	
District CBSA Enrollment Share	0.305	0.082	*	0.229	0.070	*	0.190	0.055	*	0.174	0.053	*
Wage Index (Taylor, 2004)	0.229	0.156		0.021	0.148		0.046	0.201		-0.136	0.192	
Year												
Year = 2006	0.006	0.007		0.005	0.006		0.009	0.008		0.007	0.007	
Year = 2007	0.023	0.009	*	0.017	0.007	*	0.017	0.015		0.011	0.013	
CBSA Fixed Effects												
Austin	0.003	0.013		-0.045	0.012	*	0.000	0.013		-0.050	0.012	*
San Antonio	-0.006	0.015		-0.015	0.013		-0.001	0.016		-0.016	0.015	
Dallas	0.007	0.010		0.003	0.008		-0.001	0.009		0.001	0.009	
Constant	5.098	1.086	*	6.550	0.871	*	-12.889	11.882		-4.944	10.830	
Partial F		18.410			25.420			16.560			19.290	
Hansen J (p-value)		0.306			0.804			0.982			0.813	

*p<.01, **p<.10

Recall that in the expenditure projections, the implicit poverty adjustment was approximately 25%. The elementary school with 100% subsidized lunch was expected to spend about 25% more ($5,000 rather than $4,000 per pupil) than the school with 0% subsidized lunch. No judgment was made as to whether that level of average adjustment was sufficient. The cost model in Table 3 suggests that that adjustment is insufficient.

The cost models presented in Table 3 are used to project the relative per pupil costs with respect to poverty of achieving current average outcome levels, shown in Figure 5 as the sloped trendline on each figure. The additional cost effect of poverty shown in each graph extends from just under $4,000 per pupil for the school with 0% free/reduced lunch to between $5,000 and $6,000 per pupil for the school with 100% free/reduced lunch, and is hinged around the average current spending level for all schools (a weight of about 44%, much higher than the implicit weight of current spending at 25%).[9] For the school funding system as a whole to provide equal educational opportunity across elementary schools, schools from lower to higher poverty rates should fall roughly along the trendline. However, this general pattern does not hold across all four metro areas. While an overall positive trend appears present in Houston, Austin and San Antonio CBSAs, with schools in urban core districts generally clustered around the additional cost trendline, the same is not true in the Dallas CBSA. First, in the Dallas CBSA, there are many more low poverty, non-urban core schools (hollow circles) spending well above levels of many urban core schools. Few suburban elementary schools in the other CBSAs spend over

[9] Where the 44% weight is arrived at by taking the ratio of the projected spending per pupil for a school with 100% free/reduced lunch to the projected spending for a school with 0% free/reduced lunch. This weight is similar to that estimated by Gronberg et al. (2004) (equivalent weight of .395) for the Texas Legislature in 2004, as discussed in Baker, Taylor and Vedlitz (2008).

$6,000 per pupil, but several do in the Dallas CBSA. Further, in the Dallas CBSA, while expenditures of Fort Worth schools (filled squares) are clustered around the trendline, expenditures for most Dallas elementary schools (filled triangles) fall well below the trendline, with many high poverty Dallas elementary schools spending less than $4,000 per pupil and only a handful spending at much higher levels. Given the higher spending in nearby lower poverty schools within the Dallas CBSA, both Dallas and Forth Worth face obstacles to redistribution. As shown previously, Fort Worth has achieved significantly greater success at progressive redistribution.

Figure 6
Predicted poverty related costs and spending in city district and CBSA

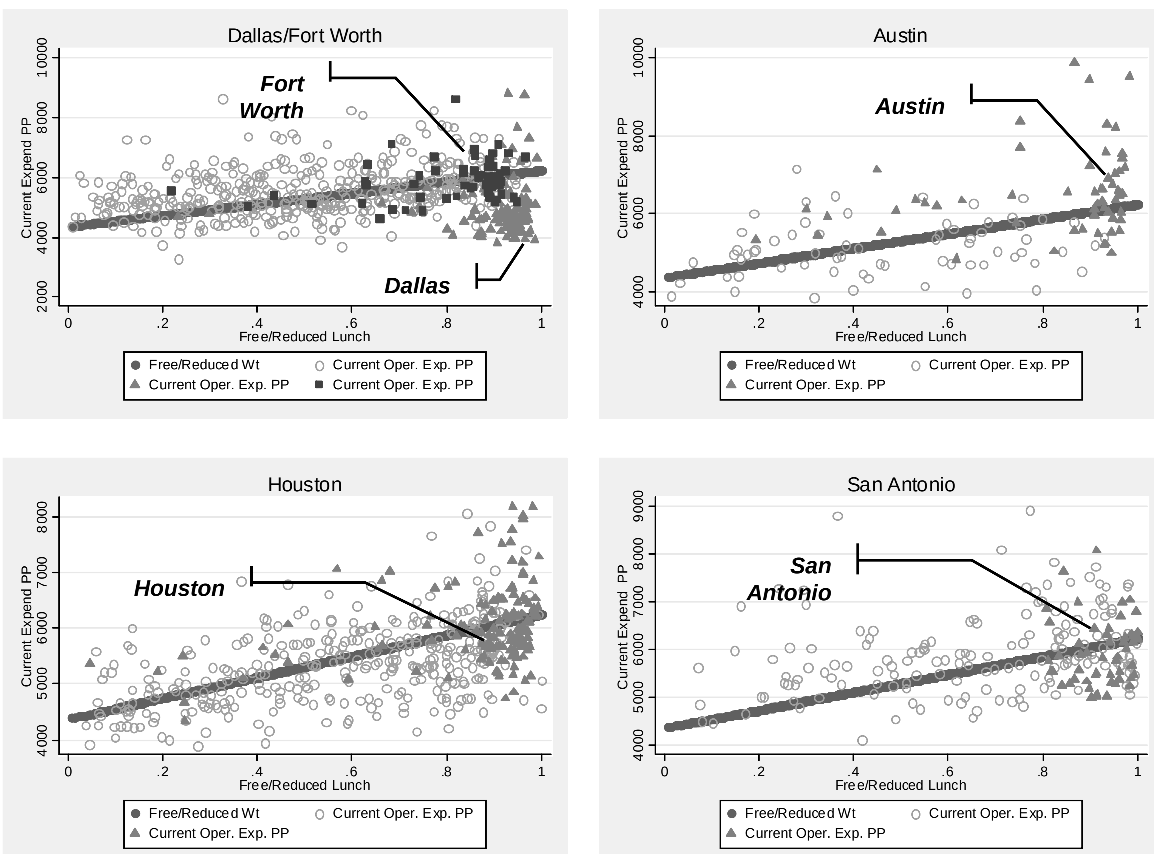


Table 4 uses the cost function model to construct cost indices (relative to producing average TAKS outcomes) and then to adjust each elementary school's current expenditure level for the cost of producing average educational outcomes – at average efficiency. Then, we regress cost adjusted current expenditures as a function of the various school characteristics used in regressions of nominal expenditures. The goal here is to understand the nature of the variation in resources across schools that exists after removing cost related variation. If most of the variation was cost related variation, then remaining variation should be a) minimal (addressed in Table 5) and b) no-longer related to cost factors. That said, random variation is not desirable.

Table 4 shows that for models including special education expenditures, Dallas relatively underfunds schools with high special education populations. Note that when nominal expenditures were the dependent variable, Dallas was the only district in which schools with higher special education shares did not spend significantly more than those with lower shares. Here, when the higher costs (from the cost model) of students with disabilities are addressed, this relationship becomes negative.

The most notable, and problematic finding (outside of persistent unexplainable variations) is the finding that in Houston, when adjusting for the costs associated with average outcomes, higher poverty schools spend systematically less per pupil. This occurs because the additional costs associated with poverty are much greater than the slope (implicit weight) between poverty and spending across Houston schools. As noted previously, Houston has selected to advantage lower poverty schools to the relative disadvantage of higher poverty ones.

Table 4

Factors associated with *Cost Adjusted* current spending

	Adj. Current Expend (Incl. Sped)			Adj. Current Expend (Excl. Sped)		
	Coef.	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Dallas						
% Disability	-1.252	0.732	**	-1.314	0.744	**
% At Risk	-0.244	0.199		-0.192	0.210	
% LEP/ELL	-0.256	0.081	*	-0.322	0.087	*
Enroll 100 to 300	0.035	0.049		0.069	0.049	
Enroll 300 to 500	0.066	0.036	**	0.065	0.038	**
Constant	8.830	0.215	*	8.713	0.225	*
R-Squared		0.227			0.245	
Fort Worth						
% Disability	-0.274	0.462		-0.287	0.521	
% At Risk	-0.131	0.081		-0.046	0.083	
% LEP/ELL	0.106	0.059	**	0.059	0.061	
Enroll 100 to 300	0.146	0.064	*	0.155	0.073	*
Enroll 300 to 500	0.006	0.020		0.033	0.021	
Constant	8.704	0.070	*	8.527	0.077	*
R-Squared		0.171			0.159	
Houston						
% Disability	-0.098	0.302		-0.395	0.357	
% At Risk	-0.170	0.049	*	-0.187	0.051	*
% LEP/ELL	0.017	0.040		0.001	0.041	
Enroll 100 to 300	-0.062	0.024	*	-0.069	0.043	
Enroll 300 to 500	-0.027	0.021		-0.029	0.021	
Constant	8.791	0.044	*	8.688	0.051	*
R-Squared		0.150			0.181	
Austin						
% Disability	0.858	0.349	*	-0.149	0.385	
% At Risk	-0.161	0.093	**	0.016	0.094	
% LEP/ELL	0.014	0.113		-0.133	0.110	
Enroll 100 to 300	0.037	0.040		0.046	0.042	
Enroll 300 to 500	-0.005	0.027		0.020	0.028	
Constant	8.750	0.049	*	8.574	0.049	*
R-Squared		0.179			0.116	
San Antonio						
% Disability	0.303	0.350		0.281	0.313	
% At Risk	-0.378	0.167	*	-0.304	0.155	**
% LEP/ELL	0.151	0.060	*	0.197	0.077	*
Enroll 100 to 300	0.076	0.026	*	0.035	0.028	
Enroll 300 to 500	-0.010	0.021		-0.002	0.019	
Constant	8.848	0.155	*	8.645	0.145	*
R-Squared		0.212			0.185	

*p<.05, **p<.10

Finally, Table 5 shows the district aggregate adjusted per pupil expenditures, standard deviations and coefficients of variation for each district and its surrounding area. When adjusted for the costs of producing average outcomes, Dallas elementary schools fall well behind their competitive environment and both the competitive environment and Dallas ISD show relatively high levels of variation in spending. San Antonio also appears at a disadvantage but has achieved greater cost adjusted within district equity. Ft. Worth and Houston are relatively well positioned, on average, compared to surrounding districts having approximately the same level of cost adjusted elementary school per pupil spending. But, Ft. Worth has achieved marginally greater equity than Houston. Austin is best positioned (or its neighbors are at a competitive disadvantage), having more cost adjusted resources per pupil than surrounding districts. Remaining variations in current expenditures (excluding special education) across Austin schools are unexplained by our major cost factors in Table 4.

Table 5
Cost Adjusted Mean School Level Expenditures

	Adjusted Current Expend (with SE)			**Adjusted Current Expend (No SE)**		
	Mean	St.Dev.	CV	Mean	St.Dev.	CV
Dallas						
CBSA	5,772.8	695.3	12%	4,904.3	598.6	12%
District	4,603.1	780.8	17%	4,160.9	744.1	18%
Ft. Worth						
CBSA	5,542.2	886.1	16%	4,740.5	719.3	15%
District	5,545.8	387.3	7%	4,922.4	368.5	7%
Houston						
CBSA	5,628.0	598.4	11%	4,765.4	435.9	9%
District	5,654.6	499.7	9%	4,879.9	451.6	9%
Austin						
CBSA	5,515.2	718.0	13%	4,696.2	484.5	10%
District	5,971.0	601.8	10%	5,027.0	415.1	8%
San Antonio						
CBSA	5,862.6	721.8	12%	4,982.0	514.6	10%
District	5,229.7	347.5	7%	4,616.9	261.2	6%

4.0 Conclusions and Policy Implications

In the present study, we find that even within the state of Texas, under a relatively highly centralized and highly state controlled weighted state school finance formula (see Author, 2004), the relative competitive position of urban core districts varies widely – with Austin possessing a significant advantage over surrounding districts, Houston and Fort Worth maintaining relative parity with surrounding districts, and Dallas and San Antonio at a relative disadvantage. These relative advantages and disadvantages in current spending are reflected in average teacher characteristics, with Austin leveraging its funding advantage to increase teacher quantities and with Dallas schools suffering both in terms of teacher quantity measures and teacher quality measures likely due to the deficit position of Dallas elementary schools.

We find that on average current spending in the metropolitan areas surrounding these large urban districts is progressively distributed with respect to school poverty rate, with an average implicit weight of 25% (25% higher spending in a school with 100% poverty compared to a school with 0% poverty). In Dallas, spending fell well below that of surrounding districts and was less progressively distributed. In San Antonio, spending fell below surroundings but was progressively distributed. Austin and Fort Worth also progressively distributed spending. Houston, while spending more on elementary schools than surrounding districts, provided a relatively flat distribution of that spending, advantaging lower poverty schools to the disadvantage of higher poverty ones.

As noted in the introduction to this article, the State of Texas could conceivably resolve these disparities by establishing a unified, statewide school-based weighted formula which (a) corrects for the between district disparities in resources and (b) provides defined within district – direct-to-school – allocations. Of course, such a formula requires negating or fixing precisely, local district revenue. Findings herein regarding additional costs when compared with findings regarding implicit weights of current spending suggest that Texas would need to scale up poverty related funding such that the higher poverty schools within each metropolitan area have sufficient resource levels relative to their neighbors. That said, many schools according to estimates herein, may already have sufficient resources relative to their neighbors, to achieve current average outcomes. These findings are not new, and are largely consistent with previous district level cost modeling in Texas (see Taylor, 2004).

Other complexities left unaddressed herein include identifying the appropriate differences in allocations to elementary, middle and secondary schools, where current differences in those allocations vary widely across districts under investigation herein, and where little clear evidence exists regarding the “correct” differentials. This study also does not address those costs not allocated to schools or the extent to which other district expenditures might be allocated to schools. District level expenditure data from Texas suggest that Dallas may not be as poorly positioned as school level expenditures suggest.

Finally, the analyses conducted herein were conducted in the context of a state with a highly organized state school finance formula, which is built around a collection of weightings and cost factors intended to create more rational distribution of resource across districts (Author, 2004). While Dallas is perceived to be a sinking ship in the analyses herein, many other large urban districts around the country are much less well positioned – entirely submerged – when compared with Dallas and highly unlikely to be able to equitably redistribute resources internally – or rearrange their deck chairs. Appendix B provides a listing of large urban districts’ current expenditures per pupil relative to the average for other districts in their same CBSA for 2005-06. Philadelphia, currently shifting toward a weighted student formula, spends less than 80% of the level in surrounding districts. Notably, the position of Philadelphia should improve under recent Pennsylvania school finance reforms, but it is unlikely that parity will be achieved quickly. Philadelphia is joined by San Francisco and New York City as city school districts that are poorly positioned to redistribute resources internally, but have attempted to in recent years with limited measurable success to date. Chambers and colleagues (2008) show that between 2001-02 and 2006-07, implicit adjustment for poverty across San Francisco schools has backslid, despite implementing weighted funding in 2002-03 (p. 74). Other major urban districts including Boston, Newark (NJ) and Pittsburgh, PA may provide more reasonable settings for reallocation.

References

Author (2008)

Author (2007)

Author (2009)

Author (2006)

Author (2008)

Author (2006)

Ajwad, M.I. (2006) Is intra-jurisdictional resource allocation equitable? An analysis of campus level spending data from Texas elementary schools. *The Quarterly Review of Economics and Finance* 46 (2006) 552-564

Andrews, M., Duncombe, W., Yinger, J. (2002). Revisiting economies of size in American education: Are we any closer to consensus? *Economics of Education Review, 21*, 245-262.

Bound, J., Jaeger, D. & Baker, R. (1995) Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak. *Journal of the American Statistical Assocation* 90 (430) 443-450.

Burke, Sarah, M. 1999. "An Analysis of Resource Inequality at the State, District, and School Levels." *Journal of Education Finance*, 24, 4, 435-458.

Chambers, J.G., Shambaugh, L., Levin, J., Muraki, M., Poland, L. (2008) A Tale of Two Cities: A Comparative Study of Student-Based Funding and School-Based Decision Making in San Francisco and Oakland Unified School Districts. American Institutes for Research. Palo Alto, CA.

Conley, D., Rooney, K. (2007) Washington Adequacy Funding Study. Eugene, OR: Education Policy Improvement Center (EPIC).

Costrell, R., Hanushek, E., Loeb, S. (2007) What do cost functions tell us about the cost of an adequate education? Unpublished manuscript presented at a conference of the Show-Me Institute (http://showmeinstitute.org/) and the Truman School of Public Affairs of the University of Missouri, Columbia, MO. http://www.smiinfo.org/papers.html

Downes (2004) What is Adequate? Operationalizing the Concept of Adequacy for New York State. http://www.albany.edu/edfin/Downes%20EFRC%20Symp%2004%20Single.pdf

Duncombe, W., Yinger, J. (2008) Measurement of Cost Differentials In H.F. Ladd & E. Fiske (eds) pp. 203-221. *Handbook of Research in Education Finance and Policy*. New York: Routledge.

Duncombe, W., Yinger, J. (2007a) Understanding the Incentives in California's Education Finance System. http://irepp.stanford.edu/documents/GDF/STUDIES/04-Duncombe-Yinger/4-Duncombe-Yinger(3-07).pdf

Duncombe, W., Yinger, J. (2007b) A Comment on School District Level Production Functions Estimated Using Spending Data. Maxwell School of Public Affairs. Syracuse University.

Duncombe, W., Yinger, J. (2006) *Estimating the Costs of Meeting Student Performance Outcomes Mandated by the Kansas State Board of Education*. (Topeka, KS: Kansas Legislative Division of Post Audit, 2006 – January) Retrieved March 1, 2006 from http://www.kslegislature.org/postaudit/audits_perform/05pa19a.pdf

Duncombe, W., Yinger, J. (2005) How Much more Does a Disadvantaged Student Cost? *Economics of Education Review* 24 (5) 513-532

Duncombe, W.D. and Yinger, J.M. (2000). Financing Higher Performance Standards: The Case of New York State. *Economics of Education Review, 19* (3), 363-86.

Duncombe, W., Yinger, J. (1999). Performance Standards and Education Cost Indexes: You Can't Have One Without the Other. In H.F. Ladd, R. Chalk, and J.S. Hansen (Eds.), *Equity and Adequacy in Education Finance: Issues and Perspectives* (pp.260-97). Washington, DC: National Academy Press.

Duncombe, W., Yinger, J. (1998) "School Finance Reforms: Aid Formulas and Equity Objectives." *National Tax Journal* 51, (2): 239-63

Duncombe, W., Yinger, J. (1997). Why Is It So Hard to Help Central City Schools? *Journal of Policy Analysis and Management, 16,* (1), 85-113.

Fuller, E., Young, M.D., Baker, B.D. (in press) Career Paths and the Influence of School Principals on Teachers. *Educational Administration Quarterly*

Gronberg, T., Jansen, D., Taylor, L., Booker, K. (2004) *School Outcomes and Schools Costs: The Cost Function Approach*. (College Station, TX: Busch School of Government and Public Service, Texas A&M University). Retrieved March 1, 2006 from http://bush.tamu.edu/research/faculty_projects/txschoolfinance/papers/SchoolOutcomesAndSchoolCosts.pdf

Hanushek, E., Rivken, S. (2007) School Quality and the Black-White Achievement Gap. Education Working Paper Archive. University of Arkansas, Department of Education Reform.

Imazeki, J., Reschovsky, A. (2004a) Estimating the Costs of Meeting the Texas Educational Accountability Standards. Testimony provided in the case of *West Orange Cove v. Neeley*. May 17, 2004.

Imazeki, J., Reschovsky, A. (2004b) Is No Child Left Beyond an Un (or under)funded Federal Mandate? Evidence from Texas. *National Tax Journal* 57 (3) 571-588

Imberman, S., Kugler, A., Sarcedote, B. (2009) Katrina's Children: Evidence on the Structure of Peer Effects from Hurricane Evacuees. NBER Working Paper No. 15291

Roza, M., Hawley-Miles, K. (2004) Understanding Student-based Budgeting as a Means to Greater School Resource Equity. Center on Reinventing Public Education: University of Washington. Working Paper

Roza, M., Guin, K., Gross, B., Deburgomaster, S. (2007) Do districts fund schools fairly? *Education Next.* Fall, 68-73

Rubenstein, R., Schwartz, A.E., Stiefel, L., Bel Hadj Amor, Hella (2007) From districts to schools: The distribution of resources across schools in big city school districts. *Economics of Education Review* 26 (5) 532-545

Stiefel, L, Rubenstein, R., Berne, R. (1998) Intra-District Equity in Four Large Cities: Data, Methods and Results." *Journal of Education Finance* 23, 4:447-467.

Taylor, Lori. 2004. "Adjusting for Geographic Variations in Teacher Compensation: Updating the Texas Cost-of-Education Index," A report prepared for the Texas Legislature Joint Committee on Public School Finance, The Texas School Finance Project. Available at http://www.capitol.state.tx.us/ psf/reports.htm.

Appendix B

District Name	Total Enrollment	Relative Poverty	Relative Current Spending
BOSTON	57,349	3.48	1.58
PITTSBURGH SCHOOL DISTRICT	32,506	2.06	1.54
NEWARK CITY	41,857	3.09	1.50
CINCINNATI CITY SCHOOL DISTRICT	36,872	2.63	1.48
DISTRICT OF COLUMBIA PUBLIC SCHOO	59,616	3.66	1.46
ATLANTA CITY SCHOOL DISTRICT	50,770	2.50	1.44
BUFFALO CITY SCHOOL DISTRICT	36,706	3.98	1.42
INDIANAPOLIS PUBLIC SCHOOLS	38,142	2.75	1.37
PHOENIX UNION HIGH SCHOOL DISTRIC	25,010	1.76	1.36
MINNEAPOLIS	38,538	2.59	1.35
TOLEDO CITY SCHOOL DISTRICT	30,423	2.98	1.33
ST LOUIS CITY	40,841	3.26	1.33
KANSAS CITY SCHOOL DISTRICT	34,730	3.13	1.30
ST. PAUL	41,274	2.44	1.30
COLUMBUS CITY SCHOOL DISTRICT	58,961	3.00	1.29
NASHVILLE-DAVIDSON COUNTY SCHOOL	72,713	1.80	1.28
DENVER COUNTY 1	72,312	2.54	1.26
COLORADO SPRINGS 11	30,959	1.38	1.26
PORTLAND SCHOOL DISTRICT 1J	47,089	1.54	1.25
LOS ANGELES UNIFIED	727,319	1.33	1.24
MEMPHIS CITY SCHOOL DISTRICT	120,275	2.35	1.23
TULSA	41,568	2.33	1.22
CLEVELAND MUNICIPAL SCHOOL DISTRI	58,788	3.26	1.20
SEATTLE	46,085	1.57	1.20
WICHITA USD 259	48,547	2.02	1.19
SACRAMENTO CITY UNIFIED	50,408	1.46	1.17
OKLA CITY	40,322	2.48	1.17
AUSTIN INDEPENDENT SCHOOL DISTRIC	81,155	3.12	1.16
FORT WORTH INDEPENDENT SCHOOL DIS	80,336	2.10	1.15
SAN DIEGO CITY UNIFIED	132,482	1.40	1.15
SAN ANTONIO INDEPENDENT SCHOOL DI	56,422	1.80	1.14
OAKLAND UNIFIED	48,135	2.15	1.14
DUVAL COUNTY SCHOOL DISTRICT	126,662	1.47	1.13
MILWAUKEE	92,395	7.38	1.13
DALLAS INDEPENDENT SCHOOL DISTRIC	161,244	2.50	1.13
DETROIT CITY SCHOOL DISTRICT	133,255	2.46	1.13
SAN JOSE UNIFIED	31,646	1.12	1.10
STOCKTON CITY UNIFIED	38,936	1.71	1.09
FRESNO UNIFIED	79,046	2.17	1.09
JEFFERSON COUNTY SCHOOL DISTRICT	98,537	1.29	1.08
OMAHA PUBLIC SCHOOLS	46,686	3.48	1.07
HOUSTON INDEPENDENT SCHOOL DISTRI	210,292	1.74	1.07
CORPUS CHRISTI INDEPENDENT SCHOOL	39,213	1.49	1.06
SANTA ANA UNIFIED	59,310	1.71	1.06
BAKERSFIELD CITY ELEMENTARY	27,890	1.70	1.05
EAST SIDE UNION HIGH	25,817	1.23	1.05
ANAHEIM UNION HIGH	33,112	1.23	1.05
ANAHEIM ELEMENTARY	20,690	1.58	1.03
BALTIMORE CITY PUBLIC SCHOOL SYST	87,643	4.53	1.03
CHARLOTTE-MECKLENBURG SCHOOLS	123,789	1.29	1.03
ALIEF INDEPENDENT SCHOOL DISTRICT	47,595	1.41	1.03
VIRGINIA BEACH CITY PUBLIC SCHOOL	74,303	1.51	1.02
EL PASO INDEPENDENT SCHOOL DISTRI	63,811	1.11	1.02
ALBUQUERQUE PUBLIC SCHOOLS	94,022	1.49	1.01
CITY OF CHICAGO SCHOOL DISTRICT 2	420,982	2.61	0.99
LONG BEACH UNIFIED	93,589	1.18	0.95
NYC-CHANCELLOR'S OFFICE	1,014,058	2.05	0.94
CARTWRIGHT ELEMENTARY DISTRICT	20,310	1.40	0.92
SAN FRANCISCO UNIFIED	56,236	1.86	0.89
ADAMS-ARAPAHOE 28J	33,301	1.62	0.88
PHILADELPHIA CITY SCHOOL DISTRICT	184,560	4.75	0.79

Data Source: Current expenditure and enrollment data from U.S. Census Fiscal Survey 2005-06. Poverty data form Small Area Income and Poverty Estimates. Labor Market Area definition from NCES Education Comparable Wage Index. Includes NCES Common Core Locale Codes for Large City (11) and for Fringe of Large City (21) only.