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Cost Indices for Tennessee Local Education Providers: A Teacher Cost Approach†

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Abstract

Policy makers need accurate measures of school district-level costs for a variety of reasons, including salary equity efforts and state-level funding of local schools. Since salaries constitute most of the operating costs for local education providers, teacher salary data provide a ready resource for constructing school cost indices. This paper provides an example of such an index, using year 2000 data for over 60,000 teachers employed by Tennessee public schools. The index is constructed using the parameters from a hedonic wage regression, and the resulting figures are published in the tables in the appendix.

Key words: school cost, hedonic regression, teacher salary, Tennessee

JEL category: I22, I28, J45

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This paper examines the cost adjustment index employed by the Tennessee state government when allocating funds to the state's 138 Local Education Agencies. The paper begins with a brief discussion of the current cost adjustment measure, and then proceeds to the estimation of an alternative index, based upon a hedonic estimation of teacher wage. An important feature of the estimation performed in this paper is the use of a county-level cost of living index as an independent variable in the hedonic estimate of teacher wage. There are three parts to the paper: first, the discussion of the current cost adjustment measure; second, the estimation of a county-level cost of living index; and third, the estimation of a education cost of operations index.

The Cost Adjustment Factor in Tennessee Public K-12 Education

In 1992, Tennessee passed the Education Improvement Act (EIA), which put in place a set of procedures for monitoring the performance of the state's 138 Local Education Agencies (LEA), and also specified a formula for the transfers of funds from the state to these local school districts. This transfer of funds, known as the Basic Education Program (BEP) involves the movement of over two billion dollars each year. As part of the BEP formula, a cost adjustment factor awards extra funds to counties with costs above the state average. The index is required by the terms of the EIA, which calls for a "cost of operations" adjustment, based on a county-level "numerical ratio, which the cost of living bears to the statewide average cost of living" (Green and Lippard 1999a: 5).

The current cost adjustment index (the Cost Differential Factor or CDF) is based on place-of-work data (the ES-202 series). All government employment is dropped and employment and wages are then aggregated to 15 sectors; the average wage is calculated for each of these sectors, in each of the 95 counties and for the state as a whole. For each county, the average wage for all sectors is calculated, using the *state* employment shares as weights. This average is then divided by the average wage for the state. The resulting index is greater than one for those counties with higher labor costs than the state average, and these counties receive additional funds through the BEP, in proportion to the size of the index (Green and Lippard 1999a: 7, 25).

The CDF makes some sense, because about 80% of all K-12 operating costs consist of payments to labor. Hence, if one can determine the inter-county differences in labor costs, one has the basis of a good cost adjustment index. The index attempts to control for differences in the composition of employment by calculating the wage paid if each county's employment were distributed across the 15-sectors in the same proportion as the state.

Criticisms of the CDF have focused on two issues. First, some small LEAs have unexpectedly shown an index above one—and qualified for additional funds—even though no analyst seriously believes these LEAs have high labor costs. Second, using the state weights for employment could potentially penalize counties with very large concentrations of employment in high-wage sectors—these high-wage jobs would occupy a higher proportion of the county's labor force than they do in the state as a whole. This second criticism has been rebutted by the University of Tennessee's Center for Economic and Business Research, which points out that any tendency for this high-wage concentration to lift wages in other sectors would lift the overall index (Green and Lippard 1999a: 8).

Apart from these two criticisms, the greatest problem with the CDF may be that it assumes the 15 sectors are comparable across counties. In fact, gross sectors such as services, manufacturing, etc., contain widely different activities and occupations in each county, and these variations often lead to wage differences—wage differences that cannot be attributed to local labor costs. Thus, the manufacturing sector for Maury County contains the elite UAW workers at Saturn, whose high wages have nothing to do with the cost of labor in Maury County and everything to do with union membership and the policies of the General Motors company. Likewise, the service sector in Anderson County would contain a substantial number of engineers and other highly skilled consultants, while the service sector in Cannon County would consist primarily of menial workers; differences in the CDF for these two counties would represent differences in the composition of employment, not differences in the cost of equivalent labor.

A related problem is that different labor markets may be experiencing quite different conditions in any given county, at any point in time. For example, the tight labor markets of the 1990's in Middle Tennessee allowed many workers to move up from minimum wage jobs to better-paying positions in manufacturing and services. As a result, labor markets became extremely tight at the lowest pay levels, prompting employers to raise wages until the minimum wage job all but disappeared. However, the flow of workers to manufacturing and services was sufficient to keep wages in those jobs fairly steady—thus the two labor markets were experiencing quite different conditions at the same time. The lesson from this story is that one cannot assume that the labor market for teachers will necessarily experience the same cost pressures as other labor markets; hence, the relative wage as represented by the CDF may not reflect the conditions prevalent in the market for teachers.

These considerations suggest that the CDF is fundamentally flawed, and have prompted state policy makers to search for alternative cost adjustment measures. The most attractive alternative measure appears to be a hedonic wage index of the kind developed by Jay Chambers (1995, 1998), at the National Center for Educational Statistics (NCES). This index embodies the same assumption as the CDF: i.e., considering that payroll accounts for about 80% of all LEA operating costs, it seems that a measure of the relative cost of labor will provide a suitable cost adjustment measure. Unlike the CDF, however, the hedonic wage index focuses specifically on the market for teachers, and corrects for differences in the composition of the teacher work force in each LEA.

Chambers' work employs teacher data from the Schools and Staffing Survey (SASS), a national sample that permits him to estimate a hedonic index for all LEAs in the United States. While his work is extremely valuable in giving some sense of teacher cost differences across the nation, it paints with too broad a brush to give the best estimate of teacher cost differences within a particular state like Tennessee. A cost of operations index for Tennessee school districts could use data sources available only for Tennessee, data superior to the sources employed by Chambers.

One data deficiency in Chambers' work is his use of proxies such as population density for the cost of living in U.S. counties. Tennessee data sources allow one to estimate a housing cost index for each of the 95 Tennessee counties. About 40% of the CPI consists of housing; because housing is by far the most important non-tradable good, it seems the component of the CPI most likely to vary from place to place in the U.S. For this reason it seems that a rough cost-of-living index can be constructed from a housing cost index. This index can be used as an independent variable in a hedonic wage index, or could even be used alone to make cost adjustments across Tennessee counties.

Hedonic Housing Index

Every year, property tax assessors in each of Tennessee's 95 counties submit data files to the state Comptroller of the Treasury. Each record in these files consists of a property parcel, with fields for appraised value, property attributes, and most recent sales price. From these data, the Tennessee Housing Development Agency annually extracts all records which: 1) consist of single family residences; and 2) were sold in the current year. These data were then made available to us.

We further edited these data to remove records that did not appear to be market transactions—i.e., exceptionally low sales prices (relative to appraised values) indicated that these homes switched owners due to inheritance, divorce, gift, etc. To ensure that sales prices reflected market prices, all properties selling at less than a third of their appraised values were dropped, as were all properties transacted through an instrument other than an accepted warranty deed. For the five years 1996-2000 almost a half million records remain after editing.

Each year, the data are found in six separate files, with six different formats; one file containing the figures for 90 counties, and then one file for each of the following counties: Knox, Hamilton, Davidson, Shelby, and Unicoi. The files of the five individual counties differ significantly in format each year, giving a total of 26 differently formatted files for the five year period. The lack of compatibility among these files creates some difficulty in estimating a hedonic housing index. The basic form of the index is as follows:

Index=value(Avg. County Structure at County Price)/value (Avg. County Structure at State Price) (1)

The denominator is estimated by a regression of housing attributes on housing price, using all of the 400,000 or so records in the data.

$$\ln(P_i) = \beta_0 + \sum_k \beta_k x_{ki} + \varepsilon_i , \qquad (2a)$$

Where P_i is the sale price of the i^{th} home, x_{ki} is the value of the k^{th} attribute (e.g., the number of square feet) of the i^{th} home, and ε_i is the disturbance term. Since hedonic functions are typically non-linear, both the dependent and some of the independent variables are specified in log form.

Each of the estimated coefficients β_k gives the value—at the level of the state as a whole—of a unit presence of the housing attribute. These coefficients are then applied to the mean value of the housing attributes in a particular county in order to get the "state price" of that county's average housing unit.

$$\hat{P}_C = \exp(\hat{\beta}_0 + \sum_k \hat{\beta}_k \overline{X}_{kC}) , \qquad (2b)$$

where the subscript C indicates mean value for the county.

The numerator could be estimated by running the same regression—this time limiting the set of observations to those within a particular county. These estimated coefficients—applied to the mean value of the housing attributes in the county—would give the "county price" of that county's average housing unit. However, this county price equals the mean price of housing units sold in the county, a convenient fact which allows one to bypass the step of running a regression for each county. Thus, the index is formed by the following relation:

Index=(Mean Home Price in County)/(Value of Avg. County Structure at State Price)

$$Index = \overline{P}_C / \hat{P}_C \qquad (2c)$$

Estimation Problems

These data present formidable challenges, because they are both inaccurate and incomplete. Obviously inaccurate records were deleted: these deletions included all structures older than 200 years; all structures smaller than 200 square feet; and all observations where the appraised value was equal to zero. Nevertheless, errors remain, as one can observe when examining the records for familiar parcels.[1] However, there is no *a priori* reason to believe that measurement errors are other than random; thus, the large number of observations make it reasonable to assume that the errors cancel each other out.

[1] The author's own 1674 square foot condominium was recorded as having 674 square feet.

The incompleteness of the data is a more serious problem. Consisting of files with 26 different formats, only six fields can be found in all of the files: price, appraised value of land, appraised value of improvements, square footage, effective year built, and actual year built. If one disregards 1996, then two more fields can be added: number of acres and month of sale. The acres field is unusable, however, since Tennessee appraisers consider the size of an urban lot as much less important than its location, and often enter a 'zero' for number of acres in urban lots. In addition, Unicoi County lacks data for time of sale in 1997 and 1998. Thus, at best, there are four independent variables available to explain price: square footage, year built, effective year built, and time of sale.

This incompleteness is particularly frustrating because some of the individual data files are relatively rich in potential independent variables such as type of exterior (brick, etc.), type of foundation, type of interior wall, type of roof, type of floor, type of road access (from heavily trafficked road to dirt road), presence of sewer connection, access to public water and electricity, and the topography of the lot. Omitting these characteristics of the housing unit will lead to omitted variable bias when estimating the imputed values of each of the remaining attributes (i.e., the estimated coefficients β_k will be likely to differ from their true value).

The price of a housing unit depends not only on the characteristics of the structure but also the structure's location. The index attempts to capture *between-county* differences in housing costs; hence, it would not be appropriate to capture in the denominator of the index (i.e., in the 'state value' of the house) differences due to county of location. On the other hand, some location characteristics attributed to *within-county* location should be considered; these might include independent variables such as the quality of road access, or the proximity of the house to railroad tracks or water.

Neglecting either type of location characteristic (within-county or between-county) leads to the same problem of omitted variable bias found when omitting characteristics of the structure. Hence, to avoid omitted variable bias, all potential determinants of housing price should be included; then, only those coefficients pertaining to characteristics of the structure or to within-county location characteristics would be used to estimate the 'state price' of the county's average house.

Heteroskedasticity and spatial autocorrelation are commonly cited problems in hedonic housing estimates. Both of these problems will bias the standard errors of the estimated coefficients; the coefficient estimates will be inefficient but consistent. Two considerations suggest that these problems are less serious than the problem of omitted variable bias. First, our concern is prediction (creating a fitted value from the estimated coefficients) rather than hypothesis testing on an individual coefficient; hence we need not be especially troubled by biased standard errors. Second, with our very large number of observations, we can be fairly comfortable with the consistency properties of our estimators.

Can and Megbolugbe (1997: 209) point out that omitted variables are an important reason for spatial autocorrelation: neighboring houses tend to have similar attributes, and when those similar attributes are unmeasured, they will have correlated error terms. The authors construct ingenious measures to capture these unmeasured attributes and reduce omitted variable bias and spatial autocorrelation. Taking the distance-weighted mean of home prices in the previous three months in the vicinity of each observation, Can and Megbolugbe find that their various measures all reduce error variance and improve model fit, while giving reasonable values for the estimated coefficients (Can and Megbolugbe 1997: 214).[2]

The Tennessee data are not geocoded, and it is therefore not possible to replicate exactly the measures used by Can and Megbolugbe. However, it is possible to assign each housing unit to a

[2] The Can-Megbolugbe variable is a 'spatially lagged' dependent variable. Spatially lagged variables are typically endogenous and cause simultaneity bias. By using only temporally lagged observations in their spatially lagged variables, Can and Megbolugbe ensured that endogeneity would not be an issue.

relatively confined sub-county region (referred to as a ‘parcel-group’ below) based on the first characters in the parcel identification code. In rural counties, we used the first two characters, in most MSA counties the first three characters, and in Davidson and Shelby the first four characters. The number of parcel-groups thus created range from 472 in Davidson County (Nashville) and 251 in Shelby County (Memphis) to five in tiny Trousdale County. In each of these sub-county areas, the average price in 1996 was calculated. This gives a measure that—like the Can and Megbolugbe distance-weighted measures—captures some of the information present in omitted variables, including characteristics of both structure and location.

The parcel-group price measure almost certainly correlates with between-county differences, since high-priced counties would be composed of sub-county areas with generally high prices. Thus, the parcel-group price coefficient would include information one expressly wishes to exclude: the between-county location effects. To help distinguish within-county location effects from between-county location effects, dummies for the individual counties are introduced as independent variables in such a way as to cause the intercept to vary across counties. Thus, the hedonic function is specified as follows:

$$\ln(P_i) = \beta_0 + \sum_k \beta_k X_{ki} + \sum_r \lambda_r L_{ri} + \gamma_0 Z_i + \varepsilon_i\,, \qquad \text{(3a)}$$

where P_i is the sale price of the i^{th} home; the k attributes measured in the x_{ki} are the characteristics of the structure; Z_i is the 1996 average price within the parcel-group; the L_{ri} are dummies for individual counties; and ε_i is the disturbance term. The ‘state price’ for the average home in each county is calculated by taking the estimated coefficients from a regression run on the entire state, and applying them to the mean values of the x_{ki} and Z_i for the county and the mean values of the L_{ri} for the state, as follows:

$$\hat{P}_C = \exp(\hat{\beta}_0 + \sum_k \hat{\beta}_k \overline{X}_{kC} + \sum_r \hat{\lambda}_r \overline{L}_{rS} + \hat{\gamma}_0 \overline{Z}_C)\,, \qquad \text{(3b)}$$

where the subscript C indicates mean value for the county, and the subscript S indicates mean value for the state. The hedonic home price index is then calculated by dividing the average home price for the county by the above estimated ‘state price’ for that average home, as below:

$$\frac{\overline{P}_C}{\hat{P}_C} = Index \qquad \text{(3c)}$$

The state average of this index then equals 1.0, while values less (greater) than 1.0 indicate housing less (more) expensive than the state average.

Estimation of Index

Combining all data for 1997, 1998, 1999, and 2000, a total of 402,887 Tennessee home sales have complete data for price, age, year built, square footage, month of sale, and average parcel-group price for 1996. Each of the variables is briefly discussed below:

- Price: price is adjusted to remove the effect of differentials in the relative amount of land with each house. This seemed necessary since the data on acreage of each property were very poor—too poor to use in the estimations. The adjustment is done as follows: adjusted price=price*(appraised value of improvements/total appraised value). The log of adjusted price is used as the dependent variable in the regressions.

- Square footage: almost always the most important independent variable in hedonic housing regressions, square footage is converted to log form, and the non-linearity of the function is modeled by including not only the log of square footage, but a squared term and an interaction term with the log of the house's age.

- Age: age is generally considered to reduce the value of a home, both because of physical depreciation and the lack of currently fashionable features in older homes. Nevertheless, an older home might have greater value if it has a more established appearance (mature trees, etc.) or if it and the surrounding neighborhood are of a vintage that appeals to current homebuyers. The variable age is intended to capture the effect of depreciation, and is created by subtracting effective year built from the year of sale. Effective year built is equal to actual year built for about 80% of all houses in the database. For the other 20%, effective year built is greater than actual year built—indicating that the structure was renovated in some considerable way. Age is converted to log form, and a squared term and an interaction term with square footage are also entered as independent variables.

- Year built: the actual year built should give some sense of vintage effects—i.e., the preference that the average person may feel toward homes built in a certain era. This independent variable will be highly collinear with age, and its effect on price will presumably be nonlinear. The year built is entered as an independent variable, along with its square, in a quadratic specification so that one might identify the most or least preferred vintage.

- Month: the month of sale combined with the year of sale allows one to construct a trend variable, showing the typical monthly change in price during the four year period. Since the dependent variable is the log of price, the coefficient for trend will give the monthly percent change in price. The trend variable allows one to separate the effects of inflation and home appreciation from other factors influencing price. In addition, dummy variables are made for each of the months, so that seasonal effects can be determined. In the usual procedure to avoid perfect collinearity, one of the dummies is dropped—the dummy for January.

- Average 1996 parcel-group price is used as a Can-Megbolugbe variable to capture 'neighborhood effects.' Price is adjusted, as described above, and the 1996 mean of the log of adjusted price is found for each of the parcel groups. Neighboring houses typically share many features, and the neighborhood effect therefore includes some features of the structure (e.g., quality of landscaping, quality of materials used in construction, type of façade) as well as some features of the location (e.g., proximity of amenities such as shopping or disamenities such as airports). To prevent the variable from including between-county effects, dummy variables are created for each of the counties. Carter and Unicoi counties are combined, and the dummy for Anderson is dropped to avoid perfect collinearity.

Table 1 (in Appendix B) reports some summary statistics for each of the variables, as well as the estimated coefficients and the p-value of a t-test in which the null hypothesis is that the coefficient equals zero. The VIF scores suggest that multicollinearity is quite pronounced for year built, age and square footage—but since the coefficients are certainly not plagued with high standard errors, multicollinearity is not a problem. The number of observations is much too large to permit the usual tests for heteroskedasticity or spatial autocorrelation. These problems, however, are critical only when attempting to make inferences on the coefficients, since they bias the standard error and not the parameter estimates (these will be inefficient, though consistent). In the present case, the fact that we are not making inferences on the coefficients, and the fact that the number of observations is extraordinarily high, can make us relatively comfortable about these results. The most worrisome weakness in the hedonic housing cost estimation remains that of omitted variables. One indication that omitted variable bias might still be a problem is that the R-squared of 0.6908 is well below the R-squared of 0.869 produced by regressing time, the dummies for months, and the log of the appraised value of improvements on log price. Thus, there are many home characteristics, visible to appraisers, that could increase the explanatory power of our model, suggesting that significant quality differences across counties may continue to be unobserved, causing us to interpret these quality differences as differences in cost. Appendix A presents an effort to evaluate the present hedonic model, by comparing it to a much more fully specified model in Davidson county.

Using mean values for each county, the estimated coefficients, and following the procedure outlined above, a value for a hedonic housing price index was constructed for the 95 Tennessee counties. Housing is the largest single item purchased by consumers, but there are many other items that should be considered when trying to formulate a general cost of living index. It seems likely, however, that housing is the item in consumer budgets whose price is most likely to vary by location—because it is a non-tradable, its price is not responsive to arbitrage over space. Most other items in a consumer budget can be traded, and one would expect the prices of these items to be fairly similar across space. Thus a rough cross-county relative cost-of-living index can be constructed, based on the one item most likely to show spatial variation.

The Bureau of Labor Statistics publishes the expenditure weights for each of the items in the CPI, and produces different weights for different regions in the country and different sizes of county (U.S. Department of Labor, 1999). Thus, one can find an expenditure weight for shelter, in the South, in counties with fewer than 50,000 persons (0.24761), and another weight for Southern counties with between 50,000 and 1,500,000 persons (0.2758). Assuming that only housing prices vary across counties, a rough relative cost-of-living index can be constructed as follows:

Cost of Living Index=100*((1-weight)*1+weight*Hedonic House Price Index) (4)

Table 2 (Appendix B) reports both the hedonic house price index and the cost of living index. These figures allow comparison of house prices and of the cost of living between pairs of Tennessee counties. For example, suppose one wishes to compare home prices between one's current home county and a potential new home county. The following formula permits this comparison:

Other county price=Home county price*(Other price index / Home price index) (5a)

Here's an example: suppose one has a $100,000 home in Rutherford County, and wishes to know the price of a comparable home in Williamson. Plugging in the home county price and finding the relevant indices from Table 2, one obtains:

$$\$100,000 * \left(\frac{1.128}{0.915}\right) = \$123,277 \qquad (5b)$$

In this paper, we are concerned with the use of these indices to estimate operating cost for Tennessee school systems. While the cost-of-living index could be used alone, as the cost-adjustment index, it seems more appropriate to use it as a cost term in the estimation of a hedonic wage function for the set of Tennessee LEAs—only in this way may one address the costs faced by school districts, rather than simply the costs faced by the average consumer in each county. In setting up this cost term for a hedonic wage regression, one should consider that LEAs may pull in teachers living outside of the district's boundaries, and that it may therefore be more appropriate to create a weighted cost-of-living index, one which considers the living costs of surrounding school districts. Each county's index was therefore adjusted by making it the weighted sum of all counties supplying workers to workplaces in that county, with the weights consisting of the percent of that work county's workers coming from a particular county of residence.

$$Adjusted\_Index_i = \sum_{j \in Counties\_of\_Residence} \frac{w_{ji}}{\sum_j w_{ji}} Index_j , \qquad (6)$$

where w_{ji} is the number of workers living in county j who work in county i. The data are drawn from the 1990 Census Journey to Work files. The resulting adjusted cost of living index is reported in Table 2 (Appendix B).

Estimating Teacher Cost

Alcoa City pays about $42,800 for its average teacher, while Overton County pays about $25,400. The difference between the salaries may be due to the fact that Alcoa City employs more expensive teachers (those with more education, more years of experience, etc.) or that Alcoa City has greater difficulty in attracting teachers (because of hostile working conditions, local disamenities, etc.) and must offer a higher wage to compensate for these unattractive features. The former factors are regarded as discretionary, since a school district may exercise choice in the quality of teacher that it hires. The later factors are labeled cost factors, since they are beyond the control of the school district. The hedonic teacher cost index must only capture the *cost* factors, and must remove the effects of the *discretionary* factors.

In the long run everything can change, and everything can be considered a discretionary factor; in the short run, everything is fixed, and everything can be considered a cost factor. The approach taken here is to try to occupy the medium term when distinguishing cost from discretionary factors. All of the characteristics of the individual teachers will be considered discretionary, even though a school district is bound by state laws, union agreements, and the norms of common decency from hiring and firing whomever it wishes each year. Management practices of the school district also qualify as discretionary factors, since the school district can create working conditions that attract or repel potential teachers. The characteristics of the local county and the student body will be taken as cost factors, since these are beyond the control of the school district.

The hedonic teacher cost function is specified with the log of teacher salary as the dependent variable and factors which may affect the supply or demand for teachers as independent variables. The following equation is estimated:

$$\ln(W_i) = \beta_0 + \sum_k \beta_k C_{ki} + \sum_r \lambda_r D_{ri} + \varepsilon_i \qquad (7)$$

where W_i is the salary for teacher i, C_{ki} is cost factor k for teacher i, D_{ri} is discretionary factor r for teacher i, and ε_i is the disturbance term; β_k and λ_r are parameters to be estimated.

The Tennessee Department of Education maintains a teacher salary database in which each observation is a teacher. The fields include teacher salary, years of experience, education, the percent of the year worked for part-time teachers, the number of extra weeks worked, the teacher's race and sex, the type of teaching license, and the job assignment. The database used in the present study depicts conditions in the 1999-2000 school year. In addition to data from the teacher salary database, there are a number of potential determinants of teacher wage that one may obtain from other sources. In what follows, each of these variables is described.

- Salary: This is the gross payment to teachers, from all sources. The log of salary is the dependent variable.

Discretionary variables

- Education: Education is given as an ordinal variable representing the number of years of post-secondary education from zero (none) to eight (the Ph.D.). Experimentation showed that a log-linear specification worked best, so no independent variables were logged. Education, education squared, and the interaction of education with years of experience and percent of the year worked were entered as independent variables.

- Years experience: years of experience ranges from 0 to 54, and is entered as an independent variable along with its square and its interaction terms with education and percent of the year worked. Typically, years of experience and education are the two most powerful determinants of teacher salary.

- Percent of the year worked: for part-time workers, the salary database gives the percent of the normal year worked. This variable is modified by assigning a value of '1' to all non-part-time workers, and can now be interpreted as the percent of the normal year worked. It is entered as an independent variable, along with its square, and interaction terms with education and years of experience.

- Extra weeks worked: The salary database recorded the number of weeks teachers worked beyond the normal school year (presumably during the summer session). This number was added to 40, to give a measure of weeks worked during the entire year.

- Sex and Race: The salary database contains a field with a categorical variable for race (and Hispanic ethnicity) and another field with a categorical variable for sex. Unfortunately, 20% to 30% of the observations listed 'unknown/not available' for race or sex. Extracting the first names for those with unspecified sex (1,374 different first names), each was categorized as either male or female. In those cases with first names that can be borne by either sex (e.g., Kim), the sex was assigned as female, since nearly 80% of the individuals in the database are female. All individuals were assigned a sex, but it was impossible to assign race to those with unknown race. The race field was therefore not used in the estimation.

- License: The salary database contains a field with a categorical variable for license held by the teacher. Dummy variables were created for each of these categories and, after some experimentation (using stepwise regression), 10 of these were chosen. By far the largest license category is 'Professional' and no dummy is used for this category. Hence, the coefficient estimates for each of the license dummies should be interpreted as the percent salary difference from holding a 'Professional' license.

- Assignment: The salary database contains a field with a categorical variable for the job assignment occupied by the teacher. Dummy variables were created for each of these categories and, after some experimentation (using stepwise regression), 10 of these were chosen. Teachers in grades two through five are not given a dummy and constitute the largest group of teachers without a dummy. Hence, the coefficient estimates for each of the assignment dummies should be interpreted as the percent salary difference from a grades two through five teacher.

- Student/Teacher ratio: Teachers presumably prefer to teach small classes and will require higher salaries when asked to teach large classes. The number of teachers at each school is calculated using the teacher salary database; the number of students at each school comes from the Tennessee Department of Education.

- Ratio of actual revenue raised to fiscal capacity: Some school districts try much harder than others in raising funds for public education. This factor affects the demand curve for teachers—those districts trying harder to raise funds will pay more for teachers.

- Percent of students expelled: This variable can either be interpreted as a discretionary factor or as a measure of student unruliness; the general sense among educational policy experts appears to be that schools have choices other than expulsion when managing unruly students, and that expulsion is seldom the best option. One would expect schools with high expulsion rates to have higher teacher salaries. These data come from the Tennessee Department of Education's spreadsheet with 1999-2000 student demographic data by school.

- Percent of students suspended: Like the expulsion rate, this variable might be taken as either a cost or discretionary factor. Milder than expulsion and hence used more frequently, a high suspension rate may indicate an administration supportive of teachers, and result in teachers willing to work for less. These data also come from the Tennessee Department of Education's spreadsheet with 1999-2000 student demographic data by school.

Cost variables treated as discretionary

- Race of student body, by school: These data come from the Tennessee Department of Education's spreadsheet giving the results of the 1999-2000 report card; the spreadsheet also contains student demographic data by school. Five variables provide information on the racial composition of students at each school: percent White; percent Black; percent Asian; percent Hispanic; and percent Native American. These variables prove to be determinants of teacher wage, and therefore must be included if one is to avoid omitted variable bias on the cost coefficients. Nevertheless, no one wishes to construct an index that allocates more or less money to a school based on the racial status of its student body. Hence, these cost factors will be treated as discretionary.

Cost variables

- Number of students, by school: Presumably, teachers prefer smaller schools, where relations with students, colleagues, staff, and administrators are familiar enough that the individual teacher can have more of an effect on school governance and on the educational development of individual students. This suggests that teachers would require a higher salary to teach in a larger school. These data come from the Tennessee Department of Education's spreadsheet with 1999-2000 student demographic data by school. In the long run this variable is certainly a discretionary factor, and in the short run a cost factor. It's treated as a medium run cost factor, on the grounds that the durability of structures and the loyalty of alumni make it difficult for a district to split up or consolidate schools.

- School physical characteristics: The Tennessee Advisory Commission for Intergovernmental Relations has compiled an inventory of the physical facilities at Tennessee public schools. One variable in this database gives the perceived condition of the school's facilities; one would expect that schools in worse physical condition would have to pay a premium to attract teachers. Another variable was constructed as the ratio of number of specialized rooms (science labs, libraries, auditoriums, cafeterias, and gymnasiums) to the number of regular classrooms. Presumably, a school with more specialized facilities would have to pay a premium for teachers capable of using these facilities.

- Percent of students with free or reduced price lunch, by school: This variable is generally considered to be the best measure of Socio-Economic Status (SES) available at the school level. *A priori*, its effect is unclear. Teachers may prefer to teach high SES students—in which case they would be willing to take a lower salary when SES is high. On the other hand, they may find it harder to teach high SES students, since high SES parents are likely to be more eager to have their children perform well in academic subjects. In the latter case, the extra burden would lead teachers to demand higher salaries when teaching high SES children. These data come from the Tennessee Department of Education's spreadsheet with 1999-2000 student demographic data by school.

- Percent of students in special education: School districts must devote additional resources to these students, and must hire specially qualified teachers. Since this work is more difficult than regular classroom teaching, the average teacher salary would be higher in districts with a high percent of students in special education. These data also come from the Tennessee Department of Education's spreadsheet with 1999-2000 student demographic data by school.

- Coefficient of variation for number of students per school, by district: Teachers may transfer from school to school within a district without terminating their employment. Hence, teachers may consider features of a district, rather than simply a school, when applying for a job. A district with a large variety of different sized schools would offer more niches in which teachers could exercise their abilities, and such a district appears to offer less risk for teachers considering a lifetime career. One would expect the salary to be lower in such a district.

- Coefficient of variation for percent of students with free or reduced price lunch, by district: A district scoring high on this variation measure would be one in which some schools are predominantly composed of low SES students and other schools have few low SES students. Would teachers prefer districts in which schools are segregated along the lines of SES? If they do, they will receive lower wages in such a district; if they don't, they will receive higher wages.

- Attendance: Educators have long recognized that attendance rates provide an implicit measure of how happy students and their parents are with a school. Schools with high attendance rates are ones where teachers can make steady progress in educating children, and where children and their parents are supportive. Teachers would accept lower wages to work in such a school. These data also come from the Tennessee Department of Education's spreadsheet with report card results for 1999-2000 by school.

- Student performance on standardized math tests: Schools with high achieving students would pay more for teachers, since standards would presumably be higher in such schools. To avoid potential endogeneity, the math attainment scores were taken from and earlier year: the 1996 Report Card. Average scores were calculated for each High School Supply Region (HSSR), a cluster of schools consisting of a single high school and the elementary and middle schools that feed it students.[3]

- Percent of county's labor force in occupations not requiring a high school degree: The 1990 Equal Employment Opportunity Files provide information on the number of residents per county in each of 512 occupations, and Clymer and McGregor (1992) provide information on the educational requirements for each of these occupations. This variable gives the percent of the county resident labor force in occupations not requiring even a high school education. Where this is high, the cultural milieu would probably not be especially supportive of education, and teachers would not find their efforts seconded by parents, making their job more difficult. In such an environment, teachers would require higher wages.

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[3] The HSSRs are identified by comparing the school individual students attended in 1999-2000 with the school attended in 2000-2001, using lists of students taking TCAP and other exams. A key is found in the Excel workbook *http://www.mtsu.edu/~eaeff/downloads/TennSchoolCosts2000.xls* .

- Percent net inmigration of households to county: The IRS county to county migration files provide the number of in and out migrants for each county. A preponderance of inmigration is a sign that the county contains features attractive to the country at large; net inmigration therefore serves as a proxy for amenities. One would expect that teachers would be willing to work for a discount in counties with significant inmigration.

- Rate of serious juvenile crime: The FBI's Uniform Crime Reports presents figures on arrests of juveniles by county; the figures used here are from 1998. The number of arrests for serious crimes (property crimes and violent crimes) are divided by the number of juveniles in each county. A county with a high incidence of serious juvenile delinquency would be an undesirable location for a teacher; teachers would receive higher salaries in such a county.

- Adjusted cost of living index: As described above, the hedonic housing cost index is first converted to a cost of living index by applying the CPI weights for housing, and then adjusted by applying weights from the Journey to Work data of 1990. A higher cost of living would cause teachers to demand higher wages.

- Adjusted average private sector wage for jobs in the county: The average private sector wage is extracted for each county from the 1998 Tennessee ES-202 data. This is then adjusted, using the Journey to Work weights. The resulting measure can be interpreted in at least three ways. First, it provides some sense of the opportunity cost for a teacher in the county; the higher the opportunity cost, the higher the wage the school district must offer. Second, it provides a sense of how a teacher might rank in status compared to the average worker in the county; if the measure is high, then teachers would rank relatively low, and the school district must offer a relatively high wage. Third, it may provide information on amenities and other omitted cost variables determining teacher wage, since these amenities would also influence wages of other workers in the county.[4]

- Adjusted resident teachers as a percent of occupations requiring college: The 1990 Equal Employment Opportunity Files provide information on the number of residents per county in each of 512 occupations, and Clymer and McGregor (1992) provide information on the educational requirements for each of these occupations. The measure is a ratio, with teachers in the numerator and the number of persons in occupations requiring college in the denominator. If the measure is high, then teaching is one of the few job options for a college-educated resident of the county, and the teacher would probably be willing to work for a lower salary.

- Percent of students with limited English: This measure is given in the Tennessee Department of Education's school district-level spreadsheet containing the results of the 1999-2000 report card. It is more difficult to teach children with limited English, and teachers would have to be paid more in places where this measure is high.

- Student Demographics: The National Center for Educational Statistics (NCES) provides data on the average daily membership by grade for each school. The allocation of students across grades may affect wages, since teachers may find certain age groups of students quite attractive and other age groups quite difficult.

[4] Note the similarity of this variable to the Can-Megbolugbe variable used in the earlier hedonic housing model—they both serve to capture the effect of omitted variables, and they both must avoid endogeneity by using temporally lagged values.

- Dummy for K-12 school district: Some districts span only a portion of the grades, and others span the full spectrum from Kindergarten through grade 12. A district with the full K–12 span is likely to offer more opportunities for a teacher, and hence be somewhat more attractive; teachers are likely to work for lower wages in such a district.

Table 3 (Appendix B) reports the estimated coefficients, and some sample statistics for the variables in the model. The number of observations (54,060) is too large to perform the usual tests for spatial autocorrelation[5] or heteroskedasticity. Nevertheless, as in the earlier case of the housing cost model, the estimated coefficients should be unbiased, so that one can feel relatively comfortable about using these coefficients to create a cost index. The model fit is quite good, and the coefficients are of the expected sign. The sign on the variable for percent of students suspended is negative, suggesting that the variable measures the support teachers receive from administration in dealing with unruly students, rather than simply measuring the presence of unruly students.

Since we were unable to check the errors for autocorrelation and heteroskedasticity, the standard errors may well be biased and we cannot make hypothesis tests using the coefficients. Nevertheless, we can use the standardized coefficients to point out which of the independent variables has the greatest influence on the dependent variable. Table 4a (Appendix B) presents the standardized coefficients, ranked from most influential to least influential. A standardized coefficient shows how many standard deviations the dependent variable changes for a one standard deviation change in the independent variable. Variables specified as polynomials or dummies are not shown since a standardized coefficient is not particularly meaningful for these specifications. The two most influential independent variables listed are those capturing some dimension of cost-of-living or amenity at the county level: the adjusted cost of living index (0.1248), and the adjusted private sector average wage (0.1241). The third most influential variable was the percent of students that are black (0.1131). Also rounding out the top five were the percent net immigration of households to the county (-0.0785); and the serious juvenile crime arrest rate (0.0685).

Figures 1 and 2 in Appendix B show how the two variables with a polynomial specification (years of experience and years of post-secondary education) affect teacher salary. Years of education is almost linearly related, though salary increases are slightly more than proportional at higher levels of education. Years of experience shows a peak at around 30 years of experience, suggesting that teachers hired prior to about 1970 have not shared as fully in salary gains as teachers hired after that date.

These results are from a regression using all Tennessee teachers as observations. The question naturally arises as to whether the results would be significantly different were the regression to employ observations in a subset of the state. Table 4b reports the results of Chow tests determining whether the coefficients derived from certain sub-samples are different from the coefficients derived from all of the state's teachers. The tests compare rural counties, the three major divisions, and the two largest counties against the state; in all cases there is a significant difference. The results are interesting in that they suggest substantial heterogeneity among the various sections of the state. Nevertheless, for the purposes of the present study the instability of the coefficients is not a problem, since our purpose is to derive a single set of state-level weights

[5] The errors are almost certainly correlated among observations within districts and are quite likely correlated among observations within related schools, such as the elementary and middle schools that feed into a specific high school. This kind of correlation could be addressed using the tools that address spatial autocorrelation. The model proved, however, to be much too large for our computer and software resources.

for teacher salary (not the weights for particular sub-regions) and we have access to the entire data set of Tennessee teachers (and need not extrapolate from the results of a sub-region).

The model suggests teachers require a higher wage when teaching black students, and that the race of students is one of the most influential independent variables. If, in fact, because of the lingering effects of racism in America, teachers are less willing to teach black children, then it would be appropriate to retain the race of students as cost variables when creating a teacher cost index. On the other hand, it probably seems unethical to most Americans to consider the race of students when allocating funds to schools. Because of this dilemma, two versions of the teacher cost index are constructed: one containing the full set of cost variables (THTC), and the other dropping student race from the set of cost variables (HTC). The hedonic teacher cost index (HTC) is constructed following Chambers (1995):

$$HTC = \exp\left(\sum_k \hat{\beta}_k \left(\overline{C}_{LEA,k} - \overline{C}_{State,k}\right)\right) \quad (8)$$

where the C_k represent the mean value of cost factor k in the school district (LEA) and state.

Teacher salaries constitute only a portion of the expenditures of a school district; a cost of operations index (COI) should therefore weight the teacher cost index by the share of expenditures going toward teacher salaries, using the following formula:

Cost of Operations Index=100*((1-salary share)*1+salary share*Teacher Cost Index) (9)

The above formula treats all expenses other than teacher salary as equally costly in all districts. For many items, such as textbooks, this assumption is probably correct. For other items, such as student transportation costs, there certainly exist large differentials. The ideal cost of operations index would construct cost indices for all of the largest expenditure categories (not simply teacher cost), weight each index by its share of total expenditure, and sum the weighted indices.

One might also use the results of the regression to produce a teacher 'quality' index—one in which each of the attributes of the average teacher in a school district are weighted by their regression coefficients:

$$VTAC = \exp\left(\sum_j \hat{\lambda}_j \left(\overline{D}_{LEA,j} - \overline{D}_{State,j}\right)\right) \quad (10)$$

where the discretionary factors D_j include all achieved characteristics describing the individual teacher (i.e., all factors describing the individual teacher *except* teacher sex, the assignment dummies, weeks worked, and percent part-time). This VTAC (Value of Teacher Achieved Characteristics) measure could be calculated at the individual, school, or LEA level. The VTAC would be of value when studying the allocation of teachers among the schools in a district or among the state's districts, since it provides a convenient way of summarizing the various dimensions of teacher 'quality' into a single metric. [6]

Table 5 (Appendix B) presents five indices: a Hedonic Teacher Cost (HTC) and Cost of Operations Index (COI) using all cost variables, and a Hedonic Teacher Cost (HTC) and Cost of Operations Index (COI) excluding the race of students from the cost variables. The table also presents teacher salaries as a share of expenditures for each school district.

Table 6 (below) presents some sample statistics for each cost index, while Table 7 (below) presents the Pearson correlation coefficients. As tables 6 and 7 show, the CDF has far the greatest

[6] The Excel workbook *http://www.mtsu.edu/~eaeff/downloads/TennSchoolCosts2000.xls* contains VTAC, HTC, and THTC calculations for each Tennessee public school, LEA, and county.

range of the indices, and the adjusted cost of living index has the narrowest range. If the COI is the most ‘correct’ of these indices, the great range of the CDF indicates that it tends to over-compensate high cost areas. The CDF has a higher correlation (0.8136) with the COI than with any other index, suggesting that the two indices are not too far apart in their relative rankings of the counties.

Table 6: Sample Statistics for Cost Indices

Index	N	Maximum	Minimum	Mean	Std Dev	Coeff of Variation
CEI	137	1.13029	0.90479	1.00000	0.04724	4.72
TCI (County)	133	1.08260	0.84830	0.95894	0.05467	5.70
TCI (District)	135	1.08550	0.77030	0.94388	0.06424	6.81
Total HTC	137	1.16477	0.79512	0.93459	0.06576	7.04
Total COI	137	1.07290	0.90216	0.96875	0.03143	3.24
HTC	137	1.12894	0.82118	0.94940	0.05701	6.00
COI	137	1.06626	0.91460	0.97590	0.02736	2.80
JTW-adjusted Cost of Living Index	137	1.02616	0.93844	0.98153	0.01850	1.88
Cost of Living Index	137	1.03532	0.93514	0.98109	0.02064	2.10
Housing Cost Index	137	1.12805	0.73804	0.92365	0.08188	8.86
CDF1999	137	1.17682	0.53483	0.81970	0.14201	17.32
CDF2002	137	1.21348	0.57335	0.81396	0.13524	16.61

Table 7: Correlation among Cost Indices

	CEI	TCI (County)	TCI (District)	Total HTC	Total COI	HTC	COI	JTW-adjusted Cost of Living Index	Cost of Living Index	Housing Cost Index	CDF1999	CDF2002
CEI	1	0.8295	0.82649	0.72097	0.71832	0.72898	0.72447	0.70366	0.68134	0.68479	0.7476	0.75669
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
TCI (County)	0.8295	1	0.9405	0.60671	0.60807	0.65444	0.65459	0.69552	0.65729	0.6632	0.68008	0.68994
	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
TCI (District)	0.82649	0.9405	1	0.51453	0.5168	0.56156	0.56162	0.66884	0.6373	0.6451	0.65606	0.65611
	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Total HTC	0.72097	0.60671	0.51453	1	0.99754	0.96363	0.96137	0.67029	0.6406	0.6454	0.8139	0.81272
	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Total COI	0.71832	0.60807	0.5168	0.99754	1	0.96269	0.96488	0.67348	0.64264	0.64762	0.82039	0.8192
	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
HTC	0.72898	0.65444	0.56156	0.96363	0.96269	1	0.99789	0.72252	0.69078	0.69677	0.84591	0.83496
	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
COI	0.72447	0.65459	0.56162	0.96137	0.96488	0.99789	1	0.72481	0.69158	0.69774	0.84977	0.83912
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001	<.0001
JTW-CLI	0.70366	0.69552	0.66884	0.67029	0.67348	0.72252	0.72481	1	0.98765	0.98968	0.56894	0.57351
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001	<.0001
CLI	0.68134	0.65729	0.6373	0.6406	0.64264	0.69078	0.69158	0.98765	1	0.99919	0.53394	0.54667
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001	<.0001
HCI	0.68479	0.6632	0.6451	0.6454	0.64762	0.69677	0.69774	0.98968	0.99919	1	0.54182	0.55238
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001	<.0001
CDF1999	0.7476	0.68008	0.65606	0.8139	0.82039	0.84591	0.84977	0.56894	0.53394	0.54182	1	0.97636
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001		<.0001
CDF2002	0.75669	0.68994	0.65611	0.81272	0.8192	0.83496	0.83912	0.57351	0.54667	0.55238	0.97636	1
	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	

Table 8 shows how changing the index changes the amount of state funding to LEAs. The BEP model is formulated in an Excel workbook. Substituting each of the indices in turn for the current CDF (CDF2002), results in changed state funding to each school district. The aggregate change in funding is shown in Table 8. One index results in increased state expenditures (Chambers’ CEI);

all other indices result in reduced expenditures. Table 9 (Appendix B) shows the percent change in state funding in each local school district. The COI would reduce state payments most dramatically in Davidson, Williamson, Shelby, and Anderson counties. It would boost payments most dramatically in Hamilton, Knox, Blount, and Sevier counties. Figure 3 (Appendix B) displays a map, showing the biggest losers (lightest color) and gainers (darkest color) should the BEP switch to the COI from the CDF.

Table 8: Change in BEP Equalized State Share when Changing Cost Index

Index	BEP Equalized State Share	Percent change	Change in funding
CEI	2,387,394,000	0.2%	4,767,000
CDF2002	2,382,627,000	0%	0
Total HTC	2,373,263,000	-0.4%	-9,364,000
HTC	2,352,625,000	-1.3%	-30,002,000
Total COI	2,331,884,000	-2.1%	-50,743,000
TCI (District)	2,326,077,000	-2.4%	-56,550,000
COI	2,322,633,000	-2.5%	-59,994,000
AJCLI	2,307,117,000	-3.2%	-75,510,000

Note: Changes are against BEP Equalized State Share when CDF2002 is used.

Summary and Conclusions

A county-level cost of operations index can be important, as in the present case where it is used in a formula allocating billions of dollars to LEAs. Small differences in the index can make big differences in the amount received by individual LEAs. Hence, accuracy in such an index is of paramount importance. The first section of the paper discussed the cost of operations index currently used in Tennessee educational funding (the CDF).

The second part of the paper attempted to construct a county-level cost-of-living index, based on the assumption that housing would be by far the most important component. However, calculating a county-level hedonic house price index is difficult because of the paucity of fields in the available data. With relatively few fields, one faces the problem of omitted variable bias, which will lead to an inaccurate index. The paper addressed the problem of omitted variables by including a variable in the spirit of Can and Megbolugbe (1997): the mean price of previous home sales in the general vicinity. This approach was evaluated in an experiment on a large urban county for which we had relatively complete information, and which could be divided up into real estate ‘zones’ in order to simulate counties. The experiment revealed that dummies are needed to control for between-county effects; and that our simple proxy for the Can–Megbolugbe variable worked quite well to reduce bias and produce an index similar to the index produced by a model with relatively few omitted variables.

The third part of the paper attempted to construct a school district-level cost-of-operations index, based on the assumption that teacher salaries would be the most important component. Using the cost-of-living index as an independent variable, together with a variety of other determinants of teacher salary, resulted in a hedonic teacher cost index. Only one problematic issue emerged from the estimation; the race of students is an important determinant of teacher wage—should student race be treated as a cost variable, or should considerations of student race be excluded from an index that influences the allocation of state funds to public schools? This paper does not attempt to resolve the issue, but presents two separate hedonic teacher cost indices—one including student race as a cost factor, the other excluding student race. These hedonic teacher cost indices are then converted to school district-level cost of operations indices by applying weights corresponding to the share of teacher salaries in total expenditures.

The final part of the paper compared alternative cost of operations indices—those created in the present study, as well as several created by Jay Chambers. The current index (the CDF) has a much wider range than the alternatives, suggesting that—if the alternatives are more accurate—

the CDF over-compensates the ‘high cost’ counties. Simulations with the BEP model produced calculations of the changes in state funding to local school districts, should the current index be changed to one of the alternatives. A few counties would receive less funding, most notably Davidson, Anderson, Shelby, and Williamson counties. Other counties—especially Knox, Hamilton, Blount, and Sevier counties—would gain funding. In all but one of the alternative scenarios, the total state funding declined.

Within the next decade, reliable cost-of-living and cost-of-operations indices should become a reality for Tennessee counties and school districts. The state’s efforts to implement GIS systems in all counties will eventually allow all home sales to be geocoded, and allow much more accurate estimation of housing cost indices. Some additional efforts will also be needed in developing and maintaining state databases such as the property tax database and the teacher salary database, to provide fields that might be especially useful in estimating cost indices. Teacher salaries make up an average of about 48% of total current expenditures for Tennessee school districts. The intuition that teacher salary is the most important component of the cost of operations is doubtless correct. Nevertheless, it is not the only component, and a complete cost of operations index should examine all major cost categories. While the task seems daunting, advances in computer technology and data collection make it highly probable that, at some point, state officials will be presented with cost indices, based on the hedonic methodology, far superior to the current CDF. It is likely that the new indices will have a smaller variance than the CDF, and will therefore lower state funding to some counties treated by the CDF as high-cost counties.

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Appendix A: Experiment on Davidson County

To evaluate the county-level index, an experiment is performed on Davidson County—a county for which we have relatively complete data. The county contains eight Multiple Listing Service (MLS) 'zones,' each of which is considered as a separate county in the experiment; thus, for each zone, we create a hedonic home price index in the manner detailed above. The purpose of the experiment is to compare the results from the following six models:

- Model 1: The most complete model: The set of independent variables contain all structural attributes (i.e., dummies for whether the exterior is brick, whether there is a basement, etc.), and some within-zone location attributes (e.g., proximity to city parks). It does *not* contain the temporally lagged parcel-group price. The dependent variable is the log of price. This can be considered the most accurate model, since it attempts as complete a specification as possible, without conflating between-zone and within-zone effects.
- Model 2: Like Model 1 except that it contains only the structural attributes and no within-zone location attributes. It does *not* contain the temporally lagged parcel-group price. The dependent variable is the log of price.
- Model 3: This contains only the attributes available for the entire Tennessee sample: square footage, age, year built, and month of sale. It does *not* contain the temporally lagged parcel-group price. The dependent variable is the log of adjusted price (adjusted as above to remove relative effect of lot value).
- Model 4: Like Model 3 except that it also contains the temporally lagged parcel-group price. The dependent variable is the log of adjusted price. *No* zone dummies are used: this should cause a bias in the remaining coefficient estimates, since within-zone effects will be conflated with between-zone effects.
- Model 5: Like Model 4 except that the temporally lagged parcel group price is adjusted by subtracting from it the mean parcel group price in each zone. This should remove the between-zone effects and provide results similar to Model 1.
- Model 6: Employing only the structural attributes available for all Tennessee counties (i.e., square feet, age, year built) and using—as a proxy for all omitted variables— the average price of 1996 sales in the same 'parcel-group.' Dummies for zone are added so that the coefficients do not incorporate between-zone information. It is expected that this model will provide results very similar to those of Model 1.

Table A-1 below presents the estimated coefficients for the six models, and some sample statistics for each of the variables. Some of the coefficients have interesting signs, but since we have not performed the requisite adequacy tests (heteroskedasticity, spatial autocorrelation) it is best not to make too much of them. The R-squared for a regression of log price on log appraised value is 0.8559, so one can see that even the best of these models could be improved with additional independent variables.

Table A-1: Estimated Coefficients and Sample Statistics: Models 1 through 6.

Variable	Description	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Maximum	Minimum	Mean
F-stat		984.66	1452.98	2633.79	2962.3	2515.91	1771.24			
R-Square		0.8041	0.7958	0.6604	0.7111	0.6764	0.7236			
N		10,843	10,843	10,843	10,843	10,843	10,843			
rlp	Log of Adjusted Price			x	x	x	x	14.5646	6.6461	11.2805
lp	Log of Price	x	x					14.8088	8.9601	11.5470
Intercept	Intercept	-85.58564***	-67.1792***	-254.80183***	-243.46249***	-246.36005***	-222.29399***			
la	Log of acres	0.20095***	0.22992***					9.7202	0.0000	2.8882
ls	Log of square footage	-1.08735***	-0.96881***	-1.17547***	-0.69689***	-1.11311***	-0.09116	9.2056	5.8406	7.2681
ly	Log of age	-0.61806***	-0.6304***	-0.54492***	-0.57299***	-0.56113***	-0.56944***	5.2470	0.6931	3.0449
laa	LA squared	0.03374***	0.03212***					94.4828	0.0000	10.3783
lss	LS squared	0.1111***	0.10476***	0.14009***	0.09656***	0.13048***	0.05589***	84.7436	34.1131	52.9797
lyy	LY squared	-0.0326***	-0.02661***	-0.06731***	-0.05096***	-0.06594***	-0.0431***	27.5313	0.4805	10.2113
lsa	LS*LA	-0.05159***	-0.05414***					71.1046	0.0000	21.1555
lay	LA*LY	0.0129***	0.01554***					44.8600	0.0000	9.0389
lsy	LS*LY	0.08401***	0.08358***	0.09376***	0.08872***	0.09547***	0.08381***	40.5373	4.6229	22.0090
v1	year built	0.1065***	0.08586***	0.27752***	0.26162***	0.26955***	0.23729***	1,998	1,750	1,969
v2	year built squared	-0.000029***	-0.000023***	-0.000072***	-0.000068***	-0.00007***	-0.000062***	3,992,004	3,062,500	3,875,485
mnth	month	0.00203**	0.00188**	0.0019*	0.00307***	0.00227**	0.00362***	12	1	6
slab	Dummy: slab foundation	0.08171	0.06739					1	0	0.17384
crawl	Dummy: crawl space	0.11472*	0.0946					1	0	0.59144
partbas	Dummy: part basement	0.22643***	0.21637***					1	0	0.09407
fullbas	Dummy: full basement	0.24216***	0.22756***					1	0	0.13880
soundness	Dummy: Condition 1	0.28195***	0.2947***					6	1	3.20603
PCTGOOD	Dummy: Condition 2	0.0111***	0.01218***					100	1	81.19911
brick	Dummy: brick façade	0.0061	0.00218					1	0	0.44711
frame	Dummy: frame façade	-0.05708***	-0.05905***					1	0	0.32048
bricfram	Dummy: frame and brick façade	-0.02489	-0.02621*					1	0	0.19386
residnhd	Dummy: residential neighborhood	-0.23537***	-0.25145***					1	0	0.73762
respudnhd	Dummy: residential with restrictions	-0.24105***	-0.24004***					1	0	0.09066
imprvres	Dummy: residential lot with improvements	0.34128***	0.3385***					1	0	0.76464
duplex	Dummy: duplex	0.25548***	0.2487***					1	0	0.02361
condo	Dummy: condo	0.1343***	0.11239***					1	0	0.14931
zerolot	Dummy: zero lot line	0.25997***	0.2723***					1	0	0.04454
qualif	Dummy: qualified for mortgage	0.18385***	0.19295***					1	0	0.89403
RR500	Dummy: Within 500 feet of railroad tracks	-0.0016						1	0	0.04307
AIRP5280	Dummy: within 1 mile of airport	-0.08326***						1	0	0.02601
PARK2640	Dummy: within half mile of park	-0.01204**						1	0	0.32454
LAKE1000	Dummy: within 1000 feet of lake	-0.02541***						1	0	0.11971
UTLIN500	Dummy: within 500 feet of utility line	-0.12905***						1	0	0.00286
STINT100	Dummy: within 100 feet of street intersection	-0.04618***						1	0	0.06437
NTAD500	Dummy: within 500 feet of major road	0.01028						1	0	0.07120
SKOL1000	Dummy: within 1000 feet of school	-0.01688*						1	0	0.09370
INTST500	Dummy: within 500 feet of interstate highway	-0.01623						1	0	0.02186
RIVER100	Dummy: within 100 feet of river	-0.02498						1	0	0.01522
CEME500	Dummy: within 500 feet of cemetary	-0.02256						1	0	0.00138
MALL5280	Dummy: within 1 mile of mall	-0.03572***						1	0	0.08042
HOSP5280	Dummy: within 1 mile of hospital	-0.0771***						1	0	0.14553
PARK500	Dummy: within 500 feet of park	-0.05834***						1	0	0.04454
MALL4_3K	Dummy: within 3 kilometers of major mall	0.10691***						1	0	0.18685
kirk500	Dummy: within 500 feet of church	-0.05749***						1	0	0.05626
acr0	Dummy: acres=0	-0.15541***	-0.08508*					1	0	0.15863
ppdd	adjusted parcel-group price 1997					0.19429***		2.55250	-1.68228	-0.18749
pp	parcel-group price 1997				0.31336***		0.23801***	14.56977	10.39792	11.62434
zn1	Dummy: MLS zone=1						0.07872***	1	0	0.16933
zn2	Dummy: MLS zone=2						0.20203***	1	0	0.28636
zn3	Dummy: MLS zone=3						0.03448*	1	0	0.03458
zn4	Dummy: MLS zone=4						-0.07053***	1	0	0.03163
zn5	Dummy: MLS zone=5						0.03459*	1	0	0.03025
zn6	Dummy: MLS zone=6						0.02757**	1	0	0.16997
zn7	Dummy: MLS zone=7						0.08936***	1	0	0.11943

*** Significantly different from zero with p-value<=0.01

** Significantly different from zero with p-value<=0.05

* Significantly different from zero with p-value<=0.10

Table A-2, below, presents the calculated hedonic price index for each of the eight MLS zones. Each of the four indices is based on the coefficients of one of the models above. The level of the index is reported and—in parentheses—the rank of the zone, from least expensive to most expensive.

Table A-2: Hedonic House Price Indices Created from Four Sets of Coefficients

zone	Model1_g	Model2_h	Model3_s	Model4_p	Model5_d	Model6_gz
1	0.987 (5)	0.974 (5)	0.973 (6)	1.003 (6)	0.968 (5)	0.992 (6)
2	1.098 (8)	1.119 (8)	1.191 (8)	1.083 (8)	1.197 (8)	1.122 (8)
3	0.909 (2)	0.892 (2)	0.910 (3)	0.969 (5)	1.009 (7)	0.949 (4)
4	0.867 (1)	0.861 (1)	0.785 (1)	0.885 (1)	0.759 (1)	0.855 (1)
5	0.918 (3)	0.921 (4)	0.926 (4)	0.963 (3)	0.924 (3)	0.949 (5)
6	0.918 (4)	0.906 (3)	0.883 (2)	0.968 (4)	0.862 (2)	0.943 (3)
7	0.996 (6)	0.993 (6)	1.001 (7)	1.009 (7)	0.972 (6)	1.003 (7)
8	1.007 (7)	1.008 (7)	0.934 (5)	0.922 (2)	0.960 (4)	0.917 (2)

The six indices are fairly similar, which itself is a reassuring result. To assess how close these indices are to each other, we calculated the mean absolute difference between all pairs of indices. The results are presented in Table A-3 below:

Table A-3: Mean Absolute Difference between Indices

	Model1_g	Model2_h	Model3_s	Model4_p	Model5_d	Model6_gz
Model1_g	0.0000	0.0097	0.0389	0.0379	0.0574	0.0296
Model2_h	0.0097	0.0000	0.0346	0.0467	0.0524	0.0317
Model3_s	0.0389	0.0346	0.0000	0.0549	0.0268	0.0373
Model4_p	0.0379	0.0467	0.0549	0.0000	0.0669	0.0188
Model5_d	0.0574	0.0524	0.0268	0.0669	0.0000	0.0542
Model6_gz	0.0296	0.0317	0.0373	0.0188	0.0542	0.0000

The housing cost index produced by Model 6 (the model used in the estimate for the 95 counties) is the closest to that produced by Models 1 and 2 (which can be taken as the 'correct' versions, since they have the most complete specification). Model 5 (which attempts to remove the between-zone effect by subtracting the mean zone parcel-group price from each parcel-group price) is the most different from Models 1 and 2, a result that indicates that dummies are the best method to remove the between-zone effects.

Table 1: Summary Statistics and Estimated Coefficients for the State of Tennessee

Variable	Description	Parameter	Std Err	Pr > |t|	VIF	Maximum	Minimum	Mean	Std Dev
lp	Log of Price (adjusted)					14.47238	8.51719	11.18081	0.71039
Intercept	Intercept	-169.21093	5.43775	<.0001	0.0				
trend	Months from Dec 1996 when property sold	0.00208	0.00004833	<.0001	1.1	48	1	24.50938	13.62669
m2	Dummy: sold in February	-0.02108	0.00331	<.0001	1.8	1	0	0.06774	0.25130
m3	Dummy: sold in March	-0.00779	0.00313	0.0127	2.0	1	0	0.08647	0.28106
m4	Dummy: sold in April	0.00881	0.00312	0.0048	2.0	1	0	0.08701	0.28186
m5	Dummy: sold in May	0.02075	0.00307	<.0001	2.1	1	0	0.09421	0.29212
m6	Dummy: sold in June	0.02797	0.00306	<.0001	2.1	1	0	0.09700	0.29596
m7	Dummy: sold in July	0.02638	0.00307	<.0001	2.1	1	0	0.09537	0.29372
m8	Dummy: sold in August	0.02074	0.00309	<.0001	2.1	1	0	0.09406	0.29191
m9	Dummy: sold in September	0.01718	0.00318	<.0001	2.0	1	0	0.08359	0.27678
m10	Dummy: sold in October	0.0221	0.00321	<.0001	2.0	1	0	0.08039	0.27190
m11	Dummy: sold in November	0.0228	0.00333	<.0001	1.9	1	0	0.07030	0.25565
m12	Dummy: sold in December	0.0165	0.0034	<.0001	1.8	1	0	0.06512	0.24673
lA	Log of Effective Age in years	0.32666	0.01083	<.0001	394.7	5.24702	0.00000	2.56293	1.14198
lS	Log of Square Foot living area	4.85969	0.03362	<.0001	592.9	9.39275	5.32301	7.35234	0.45078
lAA	LA squared	-0.09837	0.00075765	<.0001	43.9	27.53126	0.00000	7.87273	5.44221
lSS	LS squared	-0.27251	0.00216	<.0001	553.6	88.22366	28.33444	54.26008	6.77006
lAS	LS*LA	-0.00576	0.00132	<.0001	304.0	44.37464	0.00000	18.69321	8.19410
llg	log of average price of homes sold in parcel-group in 1996	0.34234	0.00186	<.0001	2.0	13.51000	8.90924	11.38119	0.47173
c2	Dummy: Bedford, TN	-0.00523	0.00985	0.5953	1.8	1	0	0.00714	0.08419
c3	Dummy: Benton, TN	-0.01222	0.01489	0.4117	1.2	1	0	0.00217	0.04658
c4	Dummy: Bledsoe, TN	-0.13586	0.02309	<.0001	1.1	1	0	0.00079	0.02813
c5	Dummy: Blount, TN	0.10923	0.00798	<.0001	2.9	1	0	0.01814	0.13346
c6	Dummy: Bradley, TN	0.06283	0.00837	<.0001	2.5	1	0	0.01399	0.11747
c7	Dummy: Campbell, TN	-0.10813	0.01073	<.0001	1.6	1	0	0.00536	0.07299
c8	Dummy: Cannon, TN	0.06459	0.0175	0.0002	1.2	1	0	0.00147	0.03830
c9	Dummy: Carroll, TN	-0.03721	0.01192	0.0018	1.4	1	0	0.00394	0.06262
c10	Dummy: Carter+Unicoi	0.06252	0.00955	<.0001	1.9	1	0	0.00798	0.08897
c11	Dummy: Cheatham, TN	0.14862	0.00999	<.0001	1.7	1	0	0.00682	0.08229
c12	Dummy: Chester, TN	-0.03029	0.01577	0.0547	1.2	1	0	0.00188	0.04336
c13	Dummy: Claiborne, TN	-0.09228	0.01384	<.0001	1.3	1	0	0.00261	0.05103
c14	Dummy: Clay, TN	-0.14726	0.02569	<.0001	1.1	1	0	0.00063	0.02510
c15	Dummy: Cocke, TN	-0.03874	0.01334	0.0037	1.3	1	0	0.00288	0.05356
c16	Dummy: Coffee, TN	-0.01156	0.00966	0.2313	1.8	1	0	0.00762	0.08696
c17	Dummy: Crockett, TN	-0.03873	0.01675	0.0208	1.2	1	0	0.00164	0.04041
c18	Dummy: Cumberland, TN	0.05817	0.00935	<.0001	1.9	1	0	0.00871	0.09291
c19	Dummy: Davidson, TN	0.08896	0.00682	<.0001	12.7	1	0	0.12002	0.32499
c20	Dummy: Decatur, TN	-0.1787	0.01755	<.0001	1.2	1	0	0.00147	0.03830
c21	Dummy: DeKalb, TN	0.06873	0.01367	<.0001	1.3	1	0	0.00269	0.05175
c22	Dummy: Dickson, TN	0.14745	0.01002	<.0001	1.7	1	0	0.00671	0.08163
c23	Dummy: Dyer, TN	-0.02285	0.0103	0.0265	1.7	1	0	0.00612	0.07798
c24	Dummy: Fayette, TN	0.05374	0.01152	<.0001	1.5	1	0	0.00432	0.06556
c25	Dummy: Fentress, TN	-0.23302	0.01618	<.0001	1.2	1	0	0.00178	0.04218
c26	Dummy: Franklin, TN	-0.04518	0.01019	<.0001	1.7	1	0	0.00634	0.07935
c27	Dummy: Gibson, TN	-0.08101	0.01	<.0001	1.8	1	0	0.00687	0.08259
c28	Dummy: Giles, TN	0.02333	0.01221	0.0561	1.4	1	0	0.00365	0.06027
c29	Dummy: Grainger, TN	-0.02845	0.01797	0.1134	1.2	1	0	0.00139	0.03719
c30	Dummy: Greene, TN	0.00874	0.00992	0.3785	1.8	1	0	0.00694	0.08305
c31	Dummy: Grundy, TN	-0.19167	0.02026	<.0001	1.1	1	0	0.00106	0.03250
c32	Dummy: Hamblen, TN	0.0635	0.00902	<.0001	2.1	1	0	0.00989	0.09897
c33	Dummy: Hamilton, TN	0.17337	0.00703	<.0001	6.5	1	0	0.05352	0.22506
c34	Dummy: Hancock, TN	-0.04496	0.03139	0.1521	1.0	1	0	0.00041	0.02029
c35	Dummy: Hardeman, TN	-0.11269	0.01432	<.0001	1.3	1	0	0.00240	0.04893
c36	Dummy: Hardin, TN	-0.13867	0.01113	<.0001	1.5	1	0	0.00480	0.06908
c37	Dummy: Hawkins, TN	0.01865	0.01008	0.0643	1.7	1	0	0.00657	0.08077
c38	Dummy: Haywood, TN	-0.02308	0.01397	0.0986	1.3	1	0	0.00254	0.05038
c39	Dummy: Henderson, TN	-0.05824	0.013	<.0001	1.3	1	0	0.00308	0.05537
c40	Dummy: Henry, TN	0.02298	0.01131	0.0423	1.5	1	0	0.00456	0.06739
c41	Dummy: Hickman, TN	0.06562	0.01437	<.0001	1.3	1	0	0.00237	0.04863
c42	Dummy: Houston, TN	-0.07729	0.02073	0.0002	1.1	1	0	0.00101	0.03169
c43	Dummy: Humphreys, TN	0.0654	0.01418	<.0001	1.3	1	0	0.00246	0.04951
c44	Dummy: Jackson, TN	-0.15157	0.01878	<.0001	1.1	1	0	0.00126	0.03542
c45	Dummy: Jefferson, TN	-0.02539	0.01025	0.0133	1.7	1	0	0.00621	0.07858
c46	Dummy: Johnson, TN	-0.03662	0.01563	0.0191	1.2	1	0	0.00192	0.04382
c47	Dummy: Knox, TN	0.14776	0.00692	<.0001	8.9	1	0	0.07773	0.26774
c48	Dummy: Lake, TN	-0.14955	0.02647	<.0001	1.1	1	0	0.00059	0.02430
c49	Dummy: Lauderdale, TN	-0.0494	0.01391	0.0004	1.3	1	0	0.00259	0.05079
c50	Dummy: Lawrence, TN	-0.04896	0.01097	<.0001	1.5	1	0	0.00502	0.07067
c51	Dummy: Lewis, TN	-0.12874	0.01687	<.0001	1.2	1	0	0.00161	0.04004
c52	Dummy: Lincoln, TN	-0.09057	0.01157	<.0001	1.5	1	0	0.00425	0.06509
c53	Dummy: Loudon, TN	0.12683	0.00992	<.0001	1.7	1	0	0.00693	0.08294
c54	Dummy: McMinn, TN	-0.06847	0.01014	<.0001	1.7	1	0	0.00641	0.07981
c55	Dummy: McNairy, TN	-0.13916	0.01313	<.0001	1.3	1	0	0.00302	0.05486
c56	Dummy: Macon, TN	-0.03456	0.0136	0.011	1.3	1	0	0.00274	0.05228
c57	Dummy: Madison, TN	0.00212	0.00798	0.7906	3.0	1	0	0.01864	0.13526
c58	Dummy: Marion, TN	0.02504	0.01339	0.0615	1.3	1	0	0.00284	0.05323
c59	Dummy: Marshall, TN	-0.0151	0.01116	0.176	1.5	1	0	0.00473	0.06860
c60	Dummy: Maury, TN	-0.01189	0.0086	0.1669	2.3	1	0	0.01229	0.11016
c61	Dummy: Meigs, TN	-0.02353	0.02084	0.2588	1.1	1	0	0.00099	0.03145
c62	Dummy: Monroe, TN	-0.04489	0.01154	0.0001	1.5	1	0	0.00428	0.06527
c63	Dummy: Montgomery, TN	0.03222	0.00749	<.0001	4.2	1	0	0.02987	0.17022
c64	Dummy: Moore, TN	-0.06458	0.02438	0.0081	1.1	1	0	0.00070	0.02649
c65	Dummy: Morgan, TN	-0.0341	0.01951	0.0805	1.1	1	0	0.00115	0.03392
c66	Dummy: Obion, TN	-0.04838	0.0114	<.0001	1.5	1	0	0.00446	0.06664
c67	Dummy: Overton, TN	-0.12425	0.01583	<.0001	1.2	1	0	0.00187	0.04322

Variable	Description	Parameter	Std Err	Pr > |t|	VIF	Maximum	Minimum	Mean	Std Dev
c68	Dummy: Perry, TN	-0.17935	0.0213	<.0001	1.1	1	0	0.00095	0.03074
c69	Dummy: Pickett, TN	0.01093	0.02486	0.6601	1.1	1	0	0.00068	0.02597
c70	Dummy: Polk, TN	-0.0499	0.0169	0.0031	1.2	1	0	0.00160	0.03998
c71	Dummy: Putnam, TN	0.00016307	0.0092	0.9859	2.0	1	0	0.00923	0.09562
c72	Dummy: Rhea, TN	-0.05187	0.01274	<.0001	1.4	1	0	0.00324	0.05682
c73	Dummy: Roane, TN	-0.00656	0.00998	0.511	1.7	1	0	0.00677	0.08202
c74	Dummy: Robertson, TN	0.06801	0.00887	<.0001	2.2	1	0	0.01080	0.10336
c75	Dummy: Rutherford, TN	-0.01805	0.00714	0.0114	6.0	1	0	0.04836	0.21452
c76	Dummy: Scott, TN	-0.21663	0.01702	<.0001	1.2	1	0	0.00158	0.03967
c77	Dummy: Sequatchie, TN	-0.15737	0.01671	<.0001	1.2	1	0	0.00164	0.04047
c78	Dummy: Sevier, TN	0.14361	0.0084	<.0001	2.5	1	0	0.01408	0.11780
c79	Dummy: Shelby, TN	0.1282	0.00673	<.0001	16.9	1	0	0.17509	0.38004
c80	Dummy: Smith, TN	0.08031	0.01428	<.0001	1.3	1	0	0.00241	0.04903
c81	Dummy: Stewart, TN	-0.02564	0.01737	0.1398	1.2	1	0	0.00150	0.03869
c82	Dummy: Sullivan, TN	0.06483	0.0077	<.0001	3.4	1	0	0.02262	0.14870
c83	Dummy: Sumner, TN	0.08483	0.00749	<.0001	4.1	1	0	0.02951	0.16923
c84	Dummy: Tipton, TN	0.01066	0.0092	0.2464	2.0	1	0	0.00932	0.09607
c85	Dummy: Trousdale, TN	0.02163	0.02285	0.3437	1.1	1	0	0.00081	0.02843
c87	Dummy: Union, TN	0.03186	0.01744	0.0677	1.2	1	0	0.00148	0.03850
c88	Dummy: Van Buren, TN	-0.20047	0.02806	<.0001	1.1	1	0	0.00052	0.02282
c89	Dummy: Warren, TN	-0.04839	0.01053	<.0001	1.6	1	0	0.00566	0.07503
c90	Dummy: Washington, TN	0.11455	0.0081	<.0001	2.8	1	0	0.01665	0.12797
c91	Dummy: Wayne, TN	-0.13914	0.01772	<.0001	1.2	1	0	0.00144	0.03791
c92	Dummy: Weakley, TN	-0.08284	0.01131	<.0001	1.5	1	0	0.00458	0.06753
c93	Dummy: White, TN	-0.02836	0.01302	0.0294	1.3	1	0	0.00307	0.05528
c94	Dummy: Williamson, TN	0.19122	0.00737	<.0001	5.2	1	0	0.03857	0.19257
c95	Dummy: Wilson, TN	0.09842	0.00791	<.0001	3.1	1	0	0.01985	0.13949
v1	Year Built	0.15862	0.00559	<.0001	45,957	2,002	1,750	1,975	24
v2	Year Built Squared	-0.00004045	0.00000144	<.0001	46,828	4,008,004	3,062,500	3,900,005	93,683

N=402,887
R-squared=0.6908

Table 2: Housing Cost and Cost of Living Indices by County

county FIPS	county name	Number of Obs	Avg Age	Avg SqFt	Avg YrBlt	Avg House Price	Avg House "Quality"	Housing Cost Index	Cost of Living Index	JTW-adjusted Cost of Living Index
1	Anderson	3,707	19	1,343	1964	57,063	61,245	0.932	0.981	0.991
3	Bedford	2,876	11	1,344	1972	53,684	57,921	0.927	0.982	0.981
5	Benton	876	24	1,180	1967	39,465	42,878	0.920	0.980	0.980
7	Bledsoe	319	18	1,222	1971	36,161	44,459	0.813	0.954	0.957
9	Blount	7,309	12	1,419	1975	72,345	69,613	1.039	1.011	1.011
11	Bradley	5,638	14	1,343	1974	61,637	62,126	0.992	0.998	0.996
13	Campbell	2,158	15	1,253	1971	43,826	52,410	0.836	0.959	0.961
15	Cannon	592	17	1,264	1969	51,856	52,175	0.994	0.998	0.996
17	Carroll	1,586	28	1,350	1960	39,747	44,277	0.898	0.975	0.975
19	Carter (Carter-Unicoi)	3,215	23	1,299	1960	47,827	48,221	0.992	0.998	0.999
21	Cheatham	2,747	8	1,432	1985	81,492	75,385	1.081	1.020	1.015
23	Chester	759	17	1,415	1970	50,397	55,754	0.904	0.976	0.974
25	Claiborne	1,052	16	1,248	1972	42,906	50,503	0.850	0.963	0.964
27	Clay	254	27	1,172	1965	28,578	35,539	0.804	0.952	0.953
29	Cocke	1,159	18	1,195	1967	39,665	44,254	0.896	0.974	0.976
31	Coffee	3,070	15	1,424	1971	56,414	61,252	0.921	0.980	0.978
33	Crockett	659	26	1,299	1961	38,450	42,898	0.896	0.974	0.975
35	Cumberland	3,508	11	1,365	1982	64,959	65,780	0.988	0.997	0.993
37	Davidson	48,355	18	1,932	1971	81,768	80,291	1.018	1.005	1.005
39	Decatur	592	25	1,198	1965	30,125	38,659	0.779	0.945	0.949
41	Dekalb	1,082	17	1,276	1971	53,934	54,042	0.998	1.000	0.997
43	Dickson	2,703	13	1,407	1975	68,833	63,750	1.080	1.020	1.016
45	Dyer	2,465	17	1,456	1969	52,811	57,992	0.911	0.978	0.976
47	Fayette	1,739	7	1,682	1984	82,510	83,924	0.983	0.996	0.996
49	Fentress	718	20	1,148	1972	29,969	40,606	0.738	0.935	0.938
51	Franklin	2,553	16	1,426	1972	55,664	62,504	0.891	0.973	0.973
53	Gibson	2,767	28	1,352	1959	38,363	44,649	0.859	0.965	0.967
55	Giles	1,469	18	1,301	1964	47,828	50,150	0.954	0.989	0.987
57	Grainger	558	21	1,212	1966	41,144	45,434	0.906	0.977	0.980
59	Greene	2,798	16	1,304	1968	49,631	52,805	0.940	0.983	0.985
61	Grundy	426	23	1,205	1963	30,959	40,249	0.769	0.943	0.948
63	Hamblen	3,986	12	1,368	1974	66,052	66,531	0.993	0.998	0.993
65	Hamilton	21,561	16	1,328	1968	71,060	64,129	1.108	1.030	1.026
67	Hancock	166	15	1,099	1972	33,971	38,137	0.891	0.973	0.973
69	Hardeman	967	25	1,358	1965	39,312	47,226	0.832	0.959	0.961
71	Hardin	1,932	16	1,399	1975	46,574	57,423	0.811	0.953	0.954
73	Hawkins	2,646	12	1,301	1973	55,064	58,008	0.949	0.987	0.990
75	Haywood	1,025	21	1,462	1966	50,005	54,924	0.910	0.978	0.978
77	Henderson	1,239	13	1,473	1975	53,383	60,731	0.879	0.970	0.969
79	Henry	1,838	24	1,310	1963	45,478	47,702	0.953	0.988	0.987
81	Hickman	955	18	1,242	1970	48,711	48,961	0.995	0.999	0.996
83	Houston	405	21	1,212	1965	34,954	40,530	0.862	0.966	0.970
85	Humphreys	990	20	1,289	1969	48,058	48,315	0.995	0.999	0.995
87	Jackson	506	18	1,140	1970	32,654	40,784	0.801	0.951	0.954
89	Jefferson	2,503	12	1,334	1976	55,668	61,285	0.908	0.977	0.982
91	Johnson	775	20	1,220	1962	42,005	46,765	0.898	0.975	0.977
93	Knox	31,315	12	1,477	1976	78,535	72,713	1.080	1.022	1.017
95	Lake	238	32	1,282	1956	30,342	37,819	0.802	0.951	0.955
97	Lauderdale	1,042	22	1,331	1963	40,679	45,872	0.887	0.972	0.973
99	Lawrence	2,022	20	1,377	1967	46,416	52,318	0.887	0.972	0.972
101	Lewis	647	17	1,307	1971	41,006	50,059	0.819	0.955	0.957
103	Lincoln	1,714	20	1,448	1964	47,332	55,617	0.851	0.963	0.964
105	Loudon	2,791	13	1,421	1972	72,670	68,705	1.058	1.014	1.008
107	Mcminn	2,583	17	1,368	1965	49,341	56,710	0.870	0.968	0.972
109	Mcnairy	1,216	18	1,311	1970	38,244	47,176	0.811	0.953	0.954
111	Macon	1,104	17	1,238	1969	41,196	45,771	0.900	0.975	0.974
113	Madison	7,511	13	1,659	1975	67,494	72,287	0.934	0.982	0.979
115	Marion	1,145	17	1,340	1969	50,506	52,867	0.955	0.989	0.987
117	Marshall	1,905	13	1,322	1969	53,469	58,261	0.918	0.980	0.980
119	Maury	4,950	11	1,517	1975	68,245	74,123	0.921	0.978	0.982
121	Meigs	399	14	1,353	1977	53,199	58,458	0.910	0.978	0.980
123	Monroe	1,724	15	1,284	1970	47,976	53,856	0.891	0.973	0.978

county FIPS	county name	Number of Obs	Avg Age	Avg SqFt	Avg YrBlt	Avg House Price	Avg House "Quality"	Housing Cost Index	Cost of Living Index	JTW-adjusted Cost of Living Index
125	Montgomery	12,033	8	1,391	1986	67,888	70,553	0.962	0.990	0.990
127	Moore	283	14	1,341	1972	51,594	59,070	0.873	0.969	0.970
129	Morgan	464	20	1,196	1969	37,713	41,881	0.900	0.975	0.975
131	Obion	1,797	26	1,360	1960	41,953	47,260	0.888	0.972	0.971
133	Overton	754	20	1,229	1969	37,717	45,837	0.823	0.956	0.958
135	Perry	381	22	1,191	1967	32,278	41,449	0.779	0.945	0.949
137	Pickett	272	12	1,117	1979	43,025	45,677	0.942	0.986	0.982
139	Polk	645	18	1,226	1965	40,027	45,159	0.886	0.972	0.973
141	Putnam	3,718	12	1,476	1979	66,115	70,949	0.932	0.981	0.978
143	Rhea	1,305	15	1,324	1973	50,838	57,468	0.885	0.971	0.980
145	Roane	2,729	19	1,362	1966	52,862	57,110	0.926	0.979	0.984
147	Robertson	4,351	9	1,480	1980	72,924	73,123	0.997	0.999	1.000
149	Rutherford	19,483	6	1,708	1989	86,414	94,437	0.915	0.977	0.982
151	Scott	635	19	1,247	1969	33,118	44,144	0.750	0.938	0.940
153	Sequatchie	661	13	1,259	1976	42,953	53,958	0.796	0.949	0.956
155	Sevier	5,671	8	1,346	1985	81,558	75,826	1.076	1.021	1.016
157	Shelby	70,540	14	1,720	1975	82,759	78,137	1.059	1.016	1.015
159	Smith	971	20	1,343	1962	50,655	50,172	1.010	1.002	0.998
161	Stewart	604	13	1,276	1976	49,604	54,623	0.908	0.977	0.979
163	Sullivan	9,115	16	1,399	1967	64,421	64,802	0.994	0.998	0.999
165	Sumner	11,889	9	1,695	1983	91,070	89,795	1.014	1.004	1.003
167	Tipton	3,753	7	1,620	1985	75,773	80,464	0.942	0.986	0.987
169	Trousdale	326	22	1,378	1960	47,321	49,702	0.952	0.988	0.987
171	Unicoi (Carter-Unicoi)	3,215	23	1,299	1960	47,827	48,221	0.992	0.998	1.000
173	Union	598	11	1,208	1977	51,759	53,811	0.962	0.991	0.992
175	Vanburen	210	17	1,185	1976	35,182	46,142	0.762	0.941	0.949
177	Warren	2,281	17	1,336	1970	50,121	56,462	0.888	0.972	0.973
179	Washington	6,710	12	1,486	1974	73,939	70,769	1.045	1.012	1.007
181	Wayne	580	27	1,188	1962	29,963	36,961	0.811	0.953	0.954
183	Weakley	1,846	25	1,405	1961	41,628	48,538	0.858	0.965	0.966
185	White	1,235	17	1,295	1970	45,991	50,782	0.906	0.977	0.976
187	Williamson	15,540	6	2,215	1989	157,277	139,424	1.128	1.035	1.020
189	Wilson	7,998	9	1,741	1983	95,295	92,693	1.028	1.008	1.006
999	Tennessee	402,887	13	1,560	1975	71,741	71,741	1.000	1.000	1.000

Table 3: Coefficients and summary statistics from Teacher Hedonic Wage Model

Variable	Label	Parameter	Std Err	Pr > |t|	VIF	Maximum	Minimum	Mean	Std Dev
GR_TOT_SAL	Gross Teacher Salary					81,235	3,832.00	36,012	7,700
Intercept	Intercept	8.91122	0.04951	<.0001	0.00				
Discretionary Factors									
yrsexp1	years of experience	0.01482	0.00067262	<.0001	367.51	54	0	13.6079	10.2195
yrsexp2	years of experience squared	-0.00042625	0.00000487	<.0001	20.49	2,916	0	289.6108	332.6293
ed1	years education	0.05744	0.00703	<.0001	333.97	8	0	4.5984	0.9338
ed2	years education squared	0.00426	0.00022029	<.0001	28.11	64	0	22.0176	8.6202
partt1	% of year worked	-5.84773	0.0585	<.0001	106.74	1	0.03	0.9928	0.0631
partt2	% of year worked squared	4.98357	0.03689	<.0001	83.62	1	0	0.9897	0.0886
edpartt	Interaction term: ED1*PARTT1	-0.03715	0.00672	<.0001	330.83	8	0	4.5653	0.9728
parttyrsexp	Interaction term: PARTT1*YRSEXP1	0.0075	0.00062743	<.0001	319.47	54	0	13.5246	10.2152
edyrsexp	Interaction term: ED1*YRSEXP1	0.00032095	0.00004559	<.0001	46.83	360	0	65.4012	53.7851
female	Dummy: Female	-0.02241	0.00097673	<.0001	1.21	1	0	0.7950	0.4037
wkswkd	Number of extra weeks worked	0.00976	0.00025022	<.0001	1.13	52	40	40.4156	1.5237
PPEL	Dummy: License	0.07666	0.01896	<.0001	1.03	1	0	0.0004	0.0192
PPHS	Dummy: License	0.08467	0.02479	0.0006	1.02	1	0	0.0002	0.0143
TradeShop	Dummy: License	0.0229	0.00648	0.0004	1.81	1	0	0.0056	0.0748
ProbTchr	Dummy: License	-0.02718	0.00241	<.0001	1.29	1	0	0.0298	0.1700
ApprTchr	Dummy: License	-0.03218	0.00153	<.0001	2.25	1	0	0.1459	0.3530
ApprSpGp	Dummy: License	-0.05609	0.02042	0.006	1.00	1	0	0.0003	0.0182
ProbPermit	Dummy: License	-0.05059	0.00311	<.0001	1.26	1	0	0.0169	0.1290
IntProbTchrA	Dummy: License	-0.02613	0.00508	<.0001	1.07	1	0	0.0054	0.0732
IntProbTchrB	Dummy: License	-0.04401	0.00325	<.0001	1.17	1	0	0.0149	0.1210
OutOfStateTchr	Dummy: License	-0.04102	0.00294	<.0001	1.05	1	0	0.0162	0.1263
ArtTchrElem	Dummy: Assignment	-0.01094	0.00357	0.0022	1.02	1	0	0.0104	0.1015
PhysEdTchrElem	Dummy: Assignment	0.00889	0.00228	<.0001	1.06	1	0	0.0267	0.1612
VocTchrTraShpCert	Dummy: Assignment	0.11333	0.00539	<.0001	3.14	1	0	0.0144	0.1193
SpecEdTchrElem	Dummy: Assignment	0.00447	0.00163	0.0061	1.06	1	0	0.0542	0.2264
SpecEdTchrSec	Dummy: Assignment	-0.00754	0.0026	0.0038	1.25	1	0	0.0242	0.1535
HomeHospitalInstr	Dummy: Assignment	-0.03683	0.02182	0.0915	1.00	1	0	0.0003	0.0161
Grade1Tchr	Dummy: Assignment	-0.00226	0.00142	0.1124	1.12	1	0	0.0776	0.2676
Grade6Tchr	Dummy: Assignment	-0.00353	0.00164	0.0311	1.12	1	0	0.0565	0.2309
Grades9to12Tchr	Dummy: Assignment	0.00657	0.00164	<.0001	3.44	1	0	0.2063	0.4046
Chapter1TchrElem	Dummy: Assignment	-0.00459	0.00232	0.0477	1.05	1	0	0.0256	0.1581
stutea	Student/Teacher ratio (at school)	0.00064966	0.0001439	<.0001	1.48	533	0	16.4210	3.8264
RAC98	ratio: actual revenue/fiscal capacity 1998 (county)	0.06561	0.0023	<.0001	1.34	2	0.60	1.0050	0.1803
v27	Expulsions-Percen-Total (at school)	0.14189	0.04039	0.0004	1.22	0.55	0	0.0020	0.0096
v43	Suspensions-Perce-Total (at school)	-0.1124	0.0074	<.0001	2.19	1	0	0.0633	0.0718
Cost Factors Treated as Discretionary									
v7	pctofStudents-White (at school)	-0.03171	0.00889	0.0004	57.09	1	0	0.7370	0.3105
v8	pctofStudents-Black (at school)	0.08238	0.00903	<.0001	56.39	1	0	0.2317	0.3039
v9	pctofStudents-Hispanic (at school)	-0.04637	0.01955	0.0177	1.86	0.26	0	0.0163	0.0253
v10	pctofStudents-Asian (at school)	0.39583	0.02839	<.0001	1.81	0.17	0	0.0110	0.0170
v11	pctofStudents-NativeAmerican (at school)	0.74927	0.15912	<.0001	1.15	0.02	0	0.0016	0.0024
Cost Factors									
v6	NumberofStudents (at school)	0.00001932	0.00000137	<.0001	2.59	2,384	0	755.3350	420.7874
v12	pctofStudents-Free/ReducedPrice (at school)	-0.03989	0.00281	<.0001	4.01	1	0	0.4261	0.2598
agg	1996 standardized TCAP math average for HSSR	0.04045	0.00443	<.0001	2.89	1.44	0.58	0.9954	0.1373
v13	pctofStudents-SpecialEducationT (at school)	0.05984	0.00834	<.0001	2.53	0.43	0	0.0914	0.0683
cv6	Coefficient of Variation: NumberofStudents (District)	-0.00035876	0.00002719	<.0001	1.36	95.45	0	50.0982	15.2838
cv12	Coefficient of Variation: pctofStudents-Free/ReducedPrice (district)	0.0002274	0.00001982	<.0001	2.09	141.42	0	48.7329	25.8830
attend	Attendance rate (at school)	-0.00573	0.00058505	<.0001	1.64	4	0	3.5076	0.8204
pnul	% Occupations No High School (county)	0.1462	0.02352	<.0001	2.00	0.38	0.24	0.2806	0.0215
serjuv	Serious Juvenile Crime Arrest rate (county)	0.00995	0.00037912	<.0001	2.65	6.65	0.00	2.5128	1.5244
ajcli	Adj. Cost of Living Index	0.01396	0.00032288	<.0001	3.12	102.62	93.84	99.6235	1.9782
ajavgwage	Adj. Private Sector Average Wage	0.0000071	0.000000157	<.0001	2.94	33,245	15,701	25,587	3,869
ajpcedc	Adj. Education workers as % College workers (county)	-0.03637	0.01413	0.01	4.54	0.45	0.13	0.1975	0.0536
LIMENGL	% students with limited english (district)	0.70473	0.05624	<.0001	2.28	0.17	0.00	0.0081	0.0095
k12sys	Dummy: K-12 district	-0.02689	0.00241	<.0001	1.35	1	0	0.9689	0.1737
tfacil	Ratio: Number specialized rooms/ classrooms	0.01063	0.0059	0.0713	1.56	1	0	0.1371	0.0757
condi	Condition of classrooms (4 highest, 0 lowest)	-0.00828	0.00053953	<.0001	1.31	4	0	2.9386	0.7615
PNET	% net inmigration of households to county	-1.41405	0.03531	<.0001	1.47	0.04	-0.01	0.0058	0.0123
pk	% school's students in kindergarten	0.01433	0.00418	0.0006	1.15	5	0	0.0741	0.1042
p2	% school's students in grade 2	0.05504	0.00874	<.0001	4.36	0.52	0	0.0834	0.0882
p3	% school's students in grade 3	-0.039	0.01	<.0001	5.77	0.52	0	0.0819	0.0862
p4	% school's students in grade 4	0.02957	0.0085	0.0005	4.05	0.53	0	0.0791	0.0851
p5	% school's students in grade 5	-0.02532	0.00503	<.0001	1.73	0.97	0	0.0758	0.0939
p9	% school's students in grade 9	0.02771	0.00594	<.0001	4.68	1	0	0.0783	0.1310
p10	% school's students in grade 10	0.05102	0.01415	0.0003	20.30	0.50	0	0.0689	0.1137
p11	% school's students in grade 11	-0.10519	0.01692	<.0001	22.78	0.43	0	0.0607	0.1007
p12	% school's students in grade 12	0.03985	0.01079	0.0002	8.13	1	0	0.0548	0.0944
F-stat	4,981								
R-Square	0.8641								
N	51,773								

Table 4a: Standardized Coefficients for Teacher Hedonic Wage Model (sorted from most influential variables to least influential). Polynomials and Dummy Variables not Considered.

Variable	Label	Std Coef
ajcli	Adjusted Cost of Living Index	0.1248
ajavgwage	Adjusted Private Sector Average Wage	0.1241
v8	pctofStudents-Black (at school)	0.1131
PNET	% net inmigration of households to county	-0.0785
serjuv	Serious Juvenile Crime Arrest rate (county)	0.0685
wkswkd	Number of extra weeks worked	0.0672
RAC98	ratio: actual revenue/fiscal capacity 1998 (county)	0.0535
p11	% school's students in grade 11	-0.0479
v12	pctofStudents-Free/ReducedPrice (at school)	-0.0468
v7	pctofStudents-White (at school)	-0.0445
v6	NumberofStudents (at school)	0.0367
v43	Suspensions-Perce-Total (at school)	-0.0365
v10	pctofStudents-Asian (at school)	0.0304
LIMENGL	% students with limited english (district)	0.0304
condi	Condition of classrooms	-0.0285
cv12	Coefficient of Variation: pctofStudents-Free/ReducedPrice (district)	0.0266
p10	% school's students in grade 10	0.0262
agg	1996 standardized TCAP math average for HSSR	0.0251
cv6	Coefficient of Variation: NumberofStudents (District)	-0.0248
p2	% school's students in grade 2	0.0219
attend	Attendance rate (at school)	-0.0212
v13	pctofStudents-SpecialEducationT (at school)	0.0185
p12	% school's students in grade 12	0.0170
p9	% school's students in grade 9	0.0164
p3	% school's students in grade 3	-0.0152
pnul	% Occupations No High School (county)	0.0142
p4	% school's students in grade 4	0.0114
stutea	Student/Teacher ratio (at school)	0.0112
p5	% school's students in grade 5	-0.0107
ajpcedc	Adjusted Education workers as % College workers (county)	-0.0088
v11	pctofStudents-NativeAmerican (at school)	0.0082
pk	% school's students in kindergarten	0.0068
v27	Expulsions-Percen-Total (at school)	0.0062
v9	pctofStudents-Hispanic (at school)	-0.0053
tfacil	Ratio: Number specialized rooms/ classrooms	0.0036

Table 4b: Chow Test Results

H0	numerator DF	denominator DF	F-stat	pval
West TN parameters same as rest of state	68	51,638	37.3112	0
Middle TN parameters same as rest of state	68	51,638	46.7551	0
East TN parameters same as rest of state	68	51,638	30.9459	0
Rural parameters same as MSA	68	51,638	100.907	0
Shelby County parameters same as rest of state	68	51,638	40.3877	0
Davidson County parameters same as rest of state	68	51,638	33.7804	0
Shelby and Davidson County parameters same as rest of state	68	51,638	60.6384	0

Table 5: Hedonic Teacher Cost (HTC) and Cost of Operations Index (COI), by District

District Number	District Name	Teacher Salary as Share of Expenditures	Total HTC	Total COI	HTC	COI
10	Anderson County	0.4951	0.9911	0.9956	1.0197	1.0098
11	Clinton City	0.5104	1.0411	1.0210	1.0640	1.0327
12	Oak Ridge City	0.4975	1.0498	1.0248	1.0559	1.0278
20	Bedford County	0.4887	0.9545	0.9777	0.9685	0.9846
30	Benton County	0.4768	0.8862	0.9457	0.9102	0.9572
40	Bledsoe County	0.4229	0.8634	0.9422	0.8884	0.9528

District Number	District Name	Teacher Salary as Share of Expenditures	Total HTC	Total COI	HTC	COI
50	Blount County	0.4963	0.9815	0.9908	1.0079	1.0039
51	Alcoa City	0.5019	0.9987	0.9994	0.9979	0.9990
52	Maryville City	0.5069	1.0094	1.0047	1.0256	1.0130
60	Bradley County	0.4925	0.9515	0.9761	0.9793	0.9898
61	Cleveland City	0.4890	0.9757	0.9881	0.9814	0.9909
70	Campbell County	0.4712	0.8599	0.9340	0.8865	0.9465
80	Cannon County	0.5035	0.8983	0.9488	0.9254	0.9624
90	Carroll County	0.2360	0.9033	0.9772	0.9175	0.9805
92	H Rock-Bruceton SS	0.4508	0.9177	0.9629	0.9247	0.9660
93	Huntingdon SSD	0.4938	0.8968	0.9490	0.9056	0.9534
94	McKenzie SSD	0.4812	0.8981	0.9510	0.9134	0.9583
95	South Carroll Co S	0.4875	0.9169	0.9595	0.9409	0.9712
97	West Carroll Co SS	0.4341	0.8869	0.9509	0.9031	0.9580
100	Carter County	0.4639	0.8944	0.9510	0.9222	0.9639
101	Elizabethton City	0.4831	0.9142	0.9586	0.9356	0.9689
110	Cheatham County	0.4760	0.9579	0.9799	0.9842	0.9925
120	Chester County	0.4629	0.8950	0.9514	0.9057	0.9564
130	Claiborne County	0.4948	0.8329	0.9173	0.8582	0.9298
140	Clay County	0.4861	0.8344	0.9195	0.8600	0.9320
150	Cocke County	0.4495	0.8903	0.9507	0.9149	0.9618
151	Newport City	0.5340	0.9406	0.9683	0.9623	0.9799
160	Coffee County	0.4906	0.9209	0.9612	0.9478	0.9744
161	Manchester City	0.4703	0.9943	0.9973	1.0153	1.0072
162	Tullahoma City	0.4974	0.9633	0.9817	0.9781	0.9891
170	Crockett County	0.4329	0.9127	0.9622	0.9242	0.9672
171	Alamo City	0.4956	0.9429	0.9717	0.9544	0.9774
172	Bells City	0.5173	1.0341	1.0176	1.0506	1.0262
180	Cumberland County	0.4587	0.8934	0.9511	0.9210	0.9637
190	Davidson County	0.4757	1.1418	1.0675	1.1028	1.0489
200	Decatur County	0.5067	0.8632	0.9307	0.8853	0.9419
210	DeKalb County	0.4717	0.9235	0.9639	0.9516	0.9772
220	Dickson County	0.4867	0.9427	0.9721	0.9626	0.9818
230	Dyer County	0.4303	0.9805	0.9916	0.9972	0.9988
231	Dyersburg City	0.4949	0.9918	0.9959	0.9957	0.9979
240	Fayette County	0.4354	0.9802	0.9914	0.9344	0.9714
250	Fentress County	0.4776	0.7951	0.9022	0.8212	0.9146
260	Franklin County	0.5146	0.8942	0.9455	0.9136	0.9555
271	Humboldt City	0.4778	0.9833	0.9920	0.9481	0.9752
272	Milan SSD	0.4896	0.9537	0.9773	0.9583	0.9796
273	Trenton SSD	0.4566	0.9432	0.9740	0.9385	0.9719
274	Bradford SSD	0.4764	0.9407	0.9717	0.9645	0.9831
275	Gibson County SSD	0.4717	0.9256	0.9649	0.9441	0.9736
280	Giles County	0.4650	0.9529	0.9781	0.9619	0.9823
290	Grainger County	0.5122	0.8780	0.9375	0.9065	0.9521
300	Greene County	0.4725	0.9005	0.9530	0.9282	0.9661
301	Greeneville City	0.4609	0.9249	0.9654	0.9422	0.9734
310	Grundy County	0.5142	0.8326	0.9139	0.8599	0.9280
320	Hamblen County	0.4974	0.9489	0.9746	0.9698	0.9850
330	Hamilton County	0.4714	1.0764	1.0360	1.0614	1.0289
340	Hancock County	0.4580	0.8475	0.9302	0.8743	0.9424
350	Hardeman County	0.4754	0.9104	0.9574	0.8861	0.9459
360	Hardin County	0.4619	0.8709	0.9404	0.8909	0.9496
370	Hawkins County	0.4908	0.9267	0.9640	0.9551	0.9779
371	Rogersville City	0.5503	0.9656	0.9811	0.9899	0.9944
380	Haywood County	0.4764	0.9958	0.9980	0.9548	0.9785
390	Henderson County	0.5134	0.8914	0.9443	0.9097	0.9536
391	Lexington City	0.5383	0.9426	0.9691	0.9496	0.9729
400	Henry County	0.4563	0.9034	0.9559	0.9233	0.9650
401	Paris SSD	0.4892	0.9623	0.9816	0.9653	0.9830
410	Hickman County	0.4394	0.8978	0.9551	0.9218	0.9656
420	Houston County	0.4493	0.8819	0.9469	0.9031	0.9565

District Number	District Name	Teacher Salary as Share of Expenditures	Total HTC	Total COI	HTC	COI
430	Humphreys County	0.4843	0.9529	0.9772	0.9786	0.9896
440	Jackson County	0.4701	0.8390	0.9243	0.8661	0.9370
450	Jefferson County	0.4675	0.8935	0.9502	0.9177	0.9615
460	Johnson County	0.4473	0.8495	0.9327	0.8754	0.9443
470	Knox County	0.4910	1.0355	1.0174	1.0424	1.0208
480	Lake County	0.4743	0.9026	0.9538	0.9029	0.9540
490	Lauderdale County	0.4753	0.9517	0.9771	0.9287	0.9661
500	Lawrence County	0.4920	0.8988	0.9502	0.9242	0.9627
510	Lewis County	0.4882	0.8654	0.9343	0.8911	0.9468
520	Lincoln County	0.5203	0.9035	0.9498	0.9228	0.9598
521	Fayetteville City	0.4969	0.9607	0.9805	0.9583	0.9793
530	Loudon County	0.4970	0.9590	0.9796	0.9859	0.9930
531	Lenoir City	0.4793	0.9758	0.9884	1.0043	1.0021
540	McMinn County	0.5006	0.9311	0.9655	0.9526	0.9763
541	Athens City	0.4688	0.9718	0.9868	0.9848	0.9929
542	Etowah City	0.5012	0.9506	0.9752	0.9769	0.9884
550	McNairy County	0.5139	0.8709	0.9337	0.8893	0.9431
560	Macon County	0.4775	0.8664	0.9362	0.8918	0.9483
570	Madison County	0.4989	1.0202	1.0101	0.9909	0.9955
580	Marion County	0.4742	0.9041	0.9545	0.9268	0.9653
581	Richard City SSD	0.5546	0.9278	0.9599	0.9520	0.9734
590	Marshall County	0.4686	0.9467	0.9750	0.9654	0.9838
600	Maury County	0.4935	1.0382	1.0188	1.0440	1.0217
610	Meigs County	0.4766	0.8585	0.9326	0.8844	0.9449
620	Monroe County	0.4453	0.8826	0.9477	0.9075	0.9588
621	Sweetwater City	0.4983	0.9134	0.9568	0.9305	0.9654
630	Montgomery County	0.4320	0.9577	0.9817	0.9489	0.9779
640	Moore County	0.4373	0.9267	0.9679	0.9527	0.9793
650	Morgan County	0.4782	0.8732	0.9394	0.9012	0.9527
660	Obion County	0.4798	0.9586	0.9802	0.9822	0.9915
661	Union City	0.4879	0.9978	0.9989	0.9808	0.9906
670	Overton County	0.4699	0.8398	0.9247	0.8668	0.9374
680	Perry County	0.4663	0.8317	0.9215	0.8547	0.9323
690	Pickett County	0.4606	0.8592	0.9352	0.8873	0.9481
700	Polk County	0.4760	0.8512	0.9292	0.8790	0.9424
710	Putnam County	0.4789	0.9301	0.9665	0.9541	0.9780
720	Rhea County	0.4410	0.9102	0.9604	0.9360	0.9718
721	Dayton City	0.5535	0.9501	0.9724	0.9672	0.9819
730	Roane County	0.4601	0.9856	0.9934	1.0122	1.0056
731	Harriman City	0.4692	0.9876	0.9942	1.0042	1.0020
740	Robertson County	0.5121	0.9555	0.9772	0.9719	0.9856
750	Rutherford County	0.5083	0.9701	0.9848	0.9810	0.9903
751	Murfreesboro City	0.5130	1.0263	1.0135	1.0127	1.0065
760	Scott County	0.4936	0.8214	0.9119	0.8482	0.9251
761	Oneida SSD	0.4803	0.8182	0.9127	0.8439	0.9250
770	Sequatchie County	0.4772	0.8398	0.9236	0.8666	0.9364
780	Sevier County	0.4743	0.9430	0.9730	0.9700	0.9858
790	Shelby County	0.5139	1.1317	1.0677	1.1289	1.0663
791	Memphis City	0.4425	1.1648	1.0729	1.0862	1.0381
800	Smith County	0.4723	0.9226	0.9634	0.9480	0.9754
810	Stewart County	0.4389	0.8566	0.9371	0.8819	0.9482
820	Sullivan County	0.4258	0.9722	0.9882	1.0035	1.0015
821	Bristol City	0.4735	0.9921	0.9963	1.0143	1.0068
822	Kingsport City	0.4924	0.9895	0.9948	1.0069	1.0034
830	Sumner County	0.5039	0.9966	0.9983	1.0151	1.0076
840	Tipton County	0.4908	0.9553	0.9781	0.9625	0.9816
841	Covington City	0.4649	1.0259	1.0120	0.9591	0.9810
850	Trousdale County	0.5067	0.8975	0.9481	0.9122	0.9555
860	Unicoi County	0.4590	0.9626	0.9828	0.9927	0.9967
870	Union County	0.4944	0.8870	0.9441	0.9149	0.9579
880	Van Buren County	0.4378	0.8717	0.9438	0.9001	0.9563

District Number	District Name	Teacher Salary as Share of Expenditures	Total HTC	Total COI	HTC	COI
890	Warren County	0.4780	0.9505	0.9763	0.9738	0.9875
900	Washington County	0.4774	0.9645	0.9831	0.9916	0.9960
901	Johnson City	0.4806	0.9747	0.9878	0.9885	0.9945
910	Wayne County	0.4969	0.8441	0.9225	0.8689	0.9348
920	Weakley County	0.4878	0.8996	0.9510	0.9176	0.9598
930	White County	0.4926	0.8597	0.9309	0.8833	0.9425
940	Williamson County	0.4461	1.0184	1.0082	1.0381	1.0170
941	Franklin SSD	0.4898	1.0518	1.0253	1.0572	1.0280
950	Wilson County	0.4088	0.9760	0.9902	0.9974	0.9989
951	Lebanon SSD	0.5238	1.0009	1.0005	1.0043	1.0023

Table 9: Percent Change in State Funds Provided to Each of the 138 LEAs with Each of the Alternative Indices (Base Case is CDF2002)

sysnum	SystemName	Total HTC	HTC	Total COI	COI	AJCLI	TCI (District)	CEI
10	Anderson County	-9.0%	-7.0%	-8.7%	-7.7%	-8.6%	-4.8%	-5.1%
11	Clinton City	-6.5%	-4.2%	-7.6%	-6.4%	-9.0%	-6.7%	-7.0%
12	Oak Ridge City	-5.7%	-4.6%	-7.1%	-6.6%	-8.7%	-6.3%	-4.9%
20	Bedford County	0.1%	0.3%	0.6%	0.7%	0.9%	0.6%	-0.1%
30	Benton County	0.1%	0.3%	0.5%	0.6%	0.8%	0.6%	-0.1%
40	Bledsoe County	0.0%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
50	Blount County	0.2%	1.4%	0.8%	1.4%	2.3%	3.2%	5.3%
51	Alcoa City	0.2%	0.8%	0.8%	1.1%	2.3%	1.3%	4.8%
52	Maryville City	0.9%	2.7%	1.2%	2.0%	2.3%	1.7%	5.0%
60	Bradley County	0.2%	0.5%	0.9%	1.0%	1.3%	1.0%	3.8%
61	Cleveland City	0.2%	0.5%	0.9%	1.0%	1.3%	1.0%	3.9%
70	Campbell County	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	1.9%
80	Cannon County	0.1%	0.2%	0.3%	0.4%	0.4%	0.3%	0.0%
90	Carroll County	0.1%	0.2%	0.4%	0.5%	0.6%	0.4%	-0.1%
92	H Rock-Bruceton SSD	0.1%	0.3%	0.5%	0.5%	0.7%	0.5%	0.0%
93	Huntingdon SSD	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	-0.1%
94	McKenzie SSD	0.1%	0.2%	0.4%	0.5%	0.7%	0.5%	-0.1%
95	South Carroll Co SSD	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	-0.1%
97	West Carroll Co SSD	0.1%	0.3%	0.4%	0.5%	0.7%	0.5%	0.0%
100	Carter County	0.1%	0.2%	0.4%	0.5%	0.6%	4.2%	1.8%
101	Elizabethton City	0.1%	0.2%	0.4%	0.5%	0.6%	2.4%	1.3%
110	Cheatham County	0.1%	0.2%	0.3%	0.4%	1.7%	4.4%	2.7%
120	Chester County	0.1%	0.2%	0.4%	0.4%	0.5%	0.4%	0.0%
130	Claiborne County	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	0.0%
140	Clay County	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	0.0%
150	Cocke County	0.1%	0.3%	0.5%	0.6%	0.7%	0.5%	1.5%
151	Newport City	0.0%	0.2%	0.4%	0.6%	0.7%	0.5%	0.2%
160	Coffee County	0.1%	0.5%	0.7%	0.9%	1.1%	0.8%	1.0%
161	Manchester City	0.2%	1.7%	0.7%	1.4%	1.1%	0.8%	0.2%
162	Tullahoma City	0.1%	0.5%	0.7%	0.9%	1.1%	0.8%	1.1%
170	Crockett County	0.1%	0.3%	0.4%	0.5%	0.5%	0.4%	0.0%
171	Alamo City	0.1%	0.3%	0.4%	0.5%	0.5%	0.4%	-0.1%
172	Bells City	2.7%	4.1%	1.7%	2.4%	0.5%	0.4%	-0.1%
180	Cumberland County	0.1%	0.4%	0.6%	0.8%	1.0%	0.7%	-0.1%
190	Davidson County	-7.5%	-12.0%	-15.9%	-18.1%	-23.4%	-21.6%	-12.6%
200	Decatur County	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	-0.1%
210	DeKalb County	0.1%	0.3%	0.5%	0.6%	0.7%	0.5%	0.0%
220	Dickson County	0.1%	0.4%	0.7%	0.8%	2.5%	4.0%	2.8%
230	Dyer County	0.1%	0.4%	0.7%	0.9%	1.1%	0.8%	0.0%
231	Dyersburg City	0.1%	0.4%	0.7%	0.8%	1.1%	0.8%	0.2%
240	Fayette County	0.1%	0.3%	0.5%	0.6%	0.8%	0.6%	2.0%
250	Fentress County	0.1%	0.2%	0.4%	0.5%	0.6%	0.4%	0.0%
260	Franklin County	0.1%	0.3%	0.5%	0.6%	0.7%	0.5%	0.0%

sysnum	SystemName	Total HTC	HTC	Total COI	COI	AJCLI	TCI (District)	CEI
271	Humboldt City	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	1.4%
272	Milan SSD	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	1.2%
273	Trenton SSD	0.1%	0.3%	0.6%	0.7%	0.9%	0.6%	0.7%
274	Bradford SSD	0.2%	0.4%	0.6%	0.7%	0.9%	0.7%	0.2%
275	Gibson County SSD	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	0.7%
280	Giles County	0.1%	0.4%	0.6%	0.8%	1.0%	0.7%	-0.1%
290	Grainger County	0.0%	0.1%	0.2%	0.3%	0.3%	0.3%	0.0%
300	Greene County	0.1%	0.4%	0.6%	0.7%	0.9%	2.1%	3.5%
301	Greeneville City	0.1%	0.4%	0.6%	0.7%	0.9%	0.9%	3.0%
310	Grundy County	0.0%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
320	Hamblen County	0.2%	0.6%	1.0%	1.1%	1.4%	1.1%	3.0%
330	Hamilton County	10.3%	9.0%	6.2%	5.6%	5.7%	4.3%	9.8%
340	Hancock County	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%	0.0%
350	Hardeman County	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	0.0%
360	Hardin County	0.1%	0.4%	0.6%	0.7%	0.9%	0.7%	-0.1%
370	Hawkins County	0.1%	0.3%	0.5%	0.6%	0.7%	3.3%	1.9%
371	Rogersville City	0.1%	0.3%	0.4%	0.5%	0.7%	0.9%	0.3%
380	Haywood County	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	0.0%
390	Henderson County	0.1%	0.3%	0.5%	0.6%	0.8%	0.6%	0.0%
391	Lexington City	0.1%	0.3%	0.5%	0.6%	0.8%	0.6%	0.0%
400	Henry County	0.1%	0.4%	0.7%	0.9%	1.1%	0.8%	-0.1%
401	Paris SSD	0.1%	0.4%	0.7%	0.8%	1.1%	0.8%	-0.1%
410	Hickman County	0.0%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
420	Houston County	0.0%	0.1%	0.2%	0.3%	0.4%	0.3%	0.0%
430	Humphreys County	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	-0.1%
440	Jackson County	0.1%	0.2%	0.3%	0.4%	0.5%	0.3%	0.0%
450	Jefferson County	0.1%	0.3%	0.4%	0.5%	0.7%	0.5%	0.0%
460	Johnson County	0.0%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
470	Knox County	3.0%	4.4%	1.9%	2.6%	2.5%	-0.2%	6.4%
480	Lake County	0.1%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
490	Lauderdale County	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	0.0%
500	Lawrence County	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	-0.1%
510	Lewis County	0.1%	0.2%	0.4%	0.4%	0.5%	0.4%	0.0%
520	Lincoln County	0.1%	0.3%	0.5%	0.6%	0.7%	0.5%	0.9%
521	Fayetteville City	0.1%	0.3%	0.5%	0.6%	0.7%	0.5%	0.1%
530	Loudon County	0.1%	0.4%	0.6%	0.7%	1.6%	0.7%	3.7%
531	Lenoir City	0.1%	0.7%	0.6%	0.9%	1.6%	0.7%	2.8%
540	McMinn County	0.1%	0.4%	0.7%	0.8%	1.0%	0.7%	1.9%
541	Athens City	0.1%	0.4%	0.7%	0.8%	1.0%	0.7%	1.2%
542	Etowah City	0.2%	0.4%	0.8%	0.9%	1.1%	0.8%	0.4%
550	McNairy County	0.1%	0.3%	0.5%	0.5%	0.7%	0.5%	0.0%
560	Macon County	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	0.0%
570	Madison County	2.7%	0.8%	2.5%	1.5%	1.9%	3.8%	1.6%
580	Marion County	0.1%	0.3%	0.6%	0.7%	0.8%	0.6%	-0.1%
581	Richard City SSD	0.1%	0.4%	0.6%	0.7%	0.8%	0.7%	0.0%
590	Marshall County	0.1%	0.4%	0.6%	0.8%	1.0%	0.7%	-0.1%
600	Maury County	-2.4%	-1.6%	-3.7%	-3.3%	-5.1%	-5.4%	-3.3%
610	Meigs County	0.0%	0.1%	0.2%	0.3%	0.3%	0.3%	0.0%
620	Monroe County	0.1%	0.3%	0.5%	0.5%	0.7%	0.5%	0.6%
621	Sweetwater City	0.1%	0.3%	0.5%	0.5%	0.7%	0.5%	0.0%
630	Montgomery County	0.1%	0.4%	0.7%	0.8%	1.1%	0.8%	6.9%
640	Moore County	0.1%	0.2%	0.4%	0.4%	0.6%	0.4%	0.0%
650	Morgan County	0.0%	0.1%	0.2%	0.2%	0.3%	0.2%	0.0%
660	Obion County	0.1%	0.4%	0.7%	0.9%	1.1%	0.8%	0.7%
661	Union City	0.2%	0.4%	0.7%	0.8%	1.1%	0.8%	0.5%
670	Overton County	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	0.0%
680	Perry County	0.1%	0.2%	0.4%	0.5%	0.6%	0.5%	-0.1%
690	Pickett County	0.0%	0.2%	0.3%	0.4%	0.5%	0.3%	0.0%
700	Polk County	0.1%	0.2%	0.4%	0.4%	0.6%	0.4%	0.0%
710	Putnam County	0.2%	0.6%	1.0%	1.1%	1.4%	1.1%	0.6%

sysnum	SystemName	Total HTC	HTC	Total COI	COI	AJCLI	TCI (District)	CEI
720	Rhea County	0.1%	0.3%	0.4%	0.5%	0.7%	0.5%	1.3%
721	Dayton City	0.0%	0.2%	0.4%	0.5%	0.6%	0.5%	0.2%
730	Roane County	-4.5%	-3.2%	-4.0%	-3.4%	-3.7%	-3.9%	-2.8%
731	Harriman City	-4.7%	-3.9%	-4.2%	-3.8%	-3.8%	-4.1%	-3.7%
740	Robertson County	0.1%	0.3%	0.5%	0.6%	0.7%	6.4%	5.1%
750	Rutherford County	-1.4%	-1.1%	-0.8%	-0.7%	-0.4%	4.8%	7.4%
751	Murfreesboro City	0.5%	-0.2%	0.2%	-0.2%	-0.5%	3.8%	7.8%
760	Scott County	0.1%	0.2%	0.4%	0.4%	0.5%	0.4%	0.0%
761	Oneida SSD	0.1%	0.2%	0.3%	0.4%	0.5%	0.4%	-0.1%
770	Sequatchie County	0.1%	0.2%	0.4%	0.4%	0.5%	0.4%	-0.1%
780	Sevier County	0.3%	0.8%	1.4%	1.6%	4.0%	1.5%	5.7%
790	Shelby County	-0.8%	-2.5%	-7.1%	-7.9%	-12.1%	-11.1%	-5.5%
791	Memphis City	1.5%	-5.4%	-6.8%	-9.8%	-12.1%	-11.2%	-5.6%
800	Smith County	0.1%	0.3%	0.5%	0.5%	0.7%	0.5%	0.0%
810	Stewart County	0.0%	0.1%	0.2%	0.3%	0.4%	0.3%	0.0%
820	Sullivan County	0.2%	1.1%	1.1%	1.5%	1.6%	3.3%	5.8%
821	Bristol City	0.2%	1.9%	1.0%	1.8%	1.6%	2.5%	5.4%
822	Kingsport City	0.2%	1.4%	1.0%	1.6%	1.5%	5.2%	6.0%
830	Sumner County	0.1%	1.7%	0.6%	1.4%	1.1%	4.2%	6.9%
840	Tipton County	0.1%	0.2%	0.3%	0.3%	0.4%	0.9%	3.3%
841	Covington City	2.0%	0.2%	1.2%	0.3%	0.4%	0.3%	1.7%
850	Trousdale County	0.1%	0.1%	0.3%	0.3%	0.4%	0.3%	0.0%
860	Unicoi County	0.1%	0.3%	0.5%	0.6%	0.7%	0.6%	1.1%
870	Union County	0.0%	0.1%	0.2%	0.2%	0.3%	0.2%	0.0%
880	Van Buren County	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%	-0.1%
890	Warren County	0.1%	0.4%	0.7%	0.8%	1.0%	0.7%	-0.1%
900	Washington County	0.2%	0.6%	1.1%	1.3%	2.4%	7.7%	5.7%
901	Johnson City	0.2%	0.6%	1.1%	1.2%	2.4%	7.7%	5.9%
910	Wayne County	0.0%	0.2%	0.3%	0.3%	0.4%	0.3%	0.0%
920	Weakley County	0.1%	0.4%	0.6%	0.7%	0.9%	0.7%	-0.1%
930	White County	0.1%	0.2%	0.4%	0.5%	0.6%	0.4%	0.0%
940	Williamson County	-18.7%	-16.4%	-18.9%	-17.9%	-17.3%	-11.4%	-8.5%
941	Franklin SSD	-16.9%	-15.4%	-18.1%	-17.4%	-17.5%	-12.6%	-8.4%
950	Wilson County	0.1%	0.4%	0.7%	0.8%	1.6%	3.6%	8.8%
951	Lebanon SSD	0.2%	0.7%	0.7%	1.0%	1.6%	2.4%	8.5%
9999	state of Tennessee	-0.4%	-1.3%	-2.1%	-2.5%	-3.2%	-2.4%	0.2%

Figure 1: Response of Teacher Salary to Years of Experience (YRSEXP)

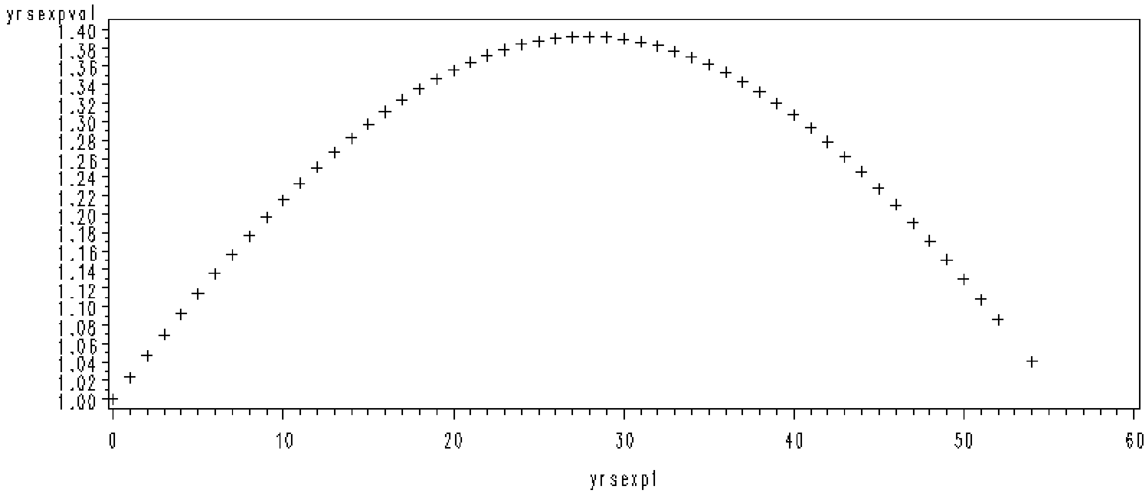

Figure 2: Response of Teacher Salary to Years of Post-Secondary Education (ED)

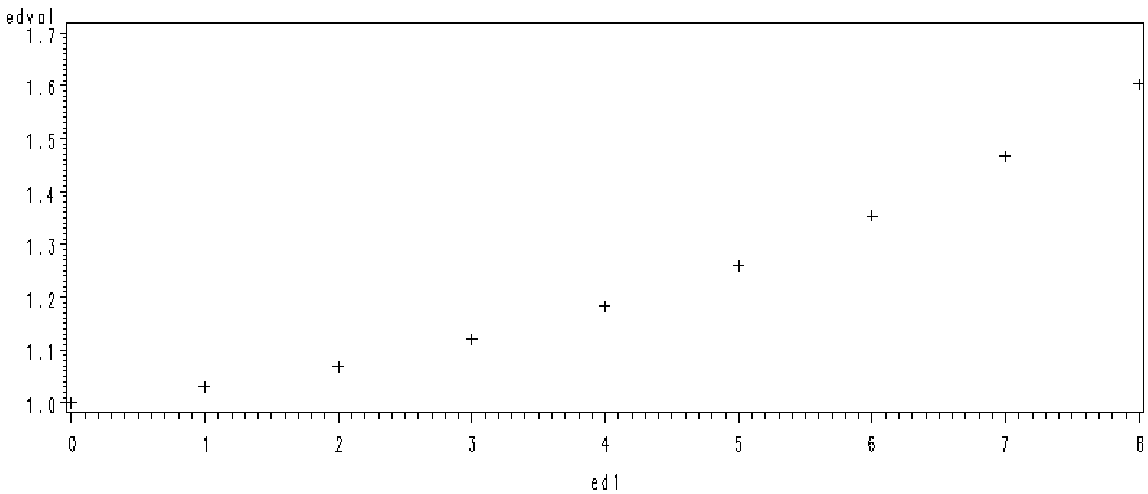

Figure 3: Percent Change in State Funding when Substituting the Total COI for the CDF2002. (Lightest color: below -0.5%; medium color: between –0.5% and 0.5%; darkest color: above 0.5%)