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ABSTRACT

The system of high-stakes accountability in the Kentucky public schools raises the question of whether teachers and administrators should be held accountable if test scores are influenced by external factors over which educators have no control. This study investigates whether such external factors , or "contextual effects," bias the accountability index scores. The focus is on the Kentucky school district accountability index scores for the 1992-94 and 1994-96 biennial periods. District scores were chosen as the focus because more suitable measures of contextual effects are available. Three contextual effects are considered: (1) median household income in the district; (2) teen birth rate; and (3) rural-metropolitan differences among districts. Contextual effects might slow or promote a school district's ability to improve its scores, or they might only influence the scores within districts. A second set of analyses were done on the 4th, 8th, and 12th grade scores within each school district. Major findings are that contextual effects have little influence on the change in scores within districts. This supports the argument of high-stakes accountability advocates, who assert that since improvement is measured within the school or district, externally imposed advantages or disadvantages will not affect the results. Contextual effects have a large influence on differences in scores between districts. Between 30 and 40% of the variation in the scores is attributable to contextual effects. Median household income is the strongest of these effects, with rural-urban differences next. When contextual effects are controlled, rural school districts perform better than their accountability scores suggest and better than metropolitan districts. Urban schools perform less well than their scores suggest when contextual effects are controlled. Independent school districts tended to score higher than county school districts. Analyses from the individual grades generally support the overall analyses. An appendix lists scores and standardized residual for each district. (Contains 2 figures, 11 tables, and 20 references.) (SLD)

STUDENTS ❖ SCHOOLS ❖ COMMUNITIES

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Executive Summary

DO CONTEXTUAL EFFECTS BIAS KENTUCKY SCHOOL DISTRICT ACCOUNTABILITY INDEX SCORES?

Kentucky's system of high-stakes accountability raises the question: Should teachers and school administrators be held accountable for student test results if the scores are influenced by external factors over which these educators have no control? The goal of the present study is to investigate if such external factors, or "contextual effects," bias the accountability index scores. The issue is important because school districts, schools, and educators should be assessed in a fair manner.

The focus of the study is on the Kentucky school district accountability index scores for the 1992-94 and 1994-96 biennia. District scores, rather than school scores, were chosen as the focus because more suitable measures of contextual effects are available for school districts than for schools. Three contextual effects are considered: (1) median household income in the district, (2) teen birth rate, and (3) rural-metropolitan differences among districts.

Two ways of determining the influence of contextual effects on the test scores are dealt with. First, contextual effects might retard or promote a school district's ability to improve its scores. A confirmation of this tendency would pose a serious problem for the current accountability system. Second, contextual effects might only influence the differences in scores between school districts. This finding would not challenge Kentucky's current procedure of recognizing improvement, which compares the present performance against the previous biennial

score within each educational unit. But it could mean that disadvantaged districts and schools will lag behind the advantaged ones no matter how much they improve on their benchmarks. This becomes a salient issue for the State's long-range goal of having all schools and districts achieve proficiency within twenty years.

A second set of analyses was done on the fourth, eighth, and twelfth grade scores within each school district. These analyses corroborate the results obtained from studying the overall district-level scores. Moreover, the grade-level results provide evidence whether contextual effects also influence the performance of individual schools.

The major findings of the study are:

- Contextual effects have little influence on the change in scores within districts. This finding supports the argument of high-stakes accountability advocates who assert that, since improvement is measured within a district or school, externally imposed advantages or disadvantages will not affect the result.
- Contextual effects have a large influence on differences in the scores between districts. In this instance, between 30 and 40 percent of the variation in the scores is attributable to contextual effects. Median household income is the strongest of these effects. Rural-metro differences are next strongest. followed by the teen birth rate. These findings warn of a danger of very substantial bias when school districts and schools are ranked using their accountability scores without first controlling for contextual effects.
- When the contextual effects are controlled. rural school districts perform better than their accountability scores suggest and better than metro districts. Metro school districts, on the other hand, perform less well than their scores suggest and less well than their rural

counterparts. The reason for these findings may be that rural school districts have less bureaucracy to contend with and stronger community support than metropolitan districts. However, this advantage of rural districts only becomes evident when the effects of median household income and teen birth rate are held constant.

- On average, the independent school districts score higher than county school districts on the accountability tests. After adding the contextual effects on the district scores, it was found that all of the positive and negative outliers were independent districts. In other words, when district scores are compared statewide and the contextual effects are held constant, the highest and lowest performing districts are independents.
- The analyses of fourth, eighth, and twelfth grade scores in each district generally support the results obtained from the overall district-level analyses. The contextual effects are found to increase with the grade level. These results suggest that contextual effects will also influence cross-school comparisons of scores but not within-school improvement in scores. As above, these results bode well for Kentucky's short-run accountability goals but raise a note of caution about whether disadvantaged schools can achieve the long-run objective of proficiency.

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Background

Recent educational reform initiatives in the United States focus on monitoring and improving outcomes and holding school districts and schools accountable for what their students learn (Ladd 1996). The current interest in performance-based education reflects in part the desire of top management, consumers and taxpayers alike to see organizational efficiency enhanced in many arenas--from private business and medical care to the military and education. But purely educational concerns also spur the interest in performance-based education. First, there is a widespread alarm that American children are not being sufficiently well trained to compete with other countries. More effective learning must be promoted to keep the U.S. labor force competitive. Second, the costs of education in the United States appear to have grown rapidly while what children learn does not show a corresponding increase.[1] Because of this, legislators and taxpayers are questioning if they are getting their money's worth in public education. Third, it is argued that the U.S. educational system must become more productive since funds to support education could be less available in the future. For many people, increasing the accountability of teachers and school systems is felt to be a way to address each of these concerns.

Currently, there are two main views about how to obtain greater efficiency and accountability in educational systems. The first view opts for creating an open market of educational services through voucher plans or tax rebates that offset the costs of alternative schooling. Parents in the role of consumers can then choose whichever school they believe will best educate their child. This perspective relies on competition between schools (within the public

[1]Ladd (1996: 2-3) argues that the perception in the United States that the costs of education have been increasing sharply is incorrect.

sector but also between the public and private sectors) to foster efficiency and academic excellence. Advocates say that parents will want their children to attend the better, more efficient schools. When such choices are aggregated, schools that are too inefficient to compete for a "market share" of students will fail, leaving only the more efficient schools. The second view on attaining more effective schools relies on an administered system of accountability that recognizes and rewards success in the public schools. This perspective has the advantage of the first because it keeps the present administrative structure of public school systems largely intact while reforming that structure to achieve accountability goals. Realistically speaking, an administered accountability system may be the only choice for states like Kentucky that have many rural school districts. Because of the higher cost of delivering education to rural areas, the open-market/parental-choice approach seems better suited for metropolitan areas.

Over the past decade these same forces have set the stage for a radical change in Kentucky's educational system, but concerns more specific to the State provided the immediate motivation for reform. Kentucky students had a record of performing below the national average on achievement tests, and high school graduation rates were low. The catalyst for reform was a law suit in which the Kentucky Supreme Court upheld a lower court decision that the State's educational system was unconstitutional. Public schools were not being funded equitably, and Kentucky students did not have equal educational opportunities.

The Kentucky Education Reform Act of 1990 (KERA) launched one of the nation's most ambitious educational reform efforts of recent decades (Elmore, Abelmann, and Fuhrman 1996). One of KERA's most noteworthy accomplishments has been the high-stakes performance assessment program, called the Kentucky Instructional Results Information System (KIRIS). This program embraced a complex procedure for testing students using authentic assessment methods. The results from the assessments have become the basis for granting monetary rewards to schools that show significant improvement and to levy sanctions against those that fail to show progress (Guskey 1994). Controversial from the start, attacks on KIRIS have intensified recently and may lead to substantial changes in the accountability program. Still, the demand in Kentucky for an effective means of assessing and improving educational performance will not go away. Whatever the shortcomings, KIRIS has put educators on notice that improved performance is expected.

The Present Study

The design and implementation of an administered accountability system raise many thorny questions (Coleman 1995; Ladd 1996): Who should be held accountable? Teachers and school officials primarily, or should parents and students be held accountable too? How will educational outcomes be measured? With criterion-referenced tests or with more "authentic" procedures such as writing portfolios and group problem-solving activities, even if the latter methods are expensive to administer and score? Whatever the method of assessment, how will problems such as "teaching to the test" and cheating be minimized? What is an appropriate way to link performance to rewards and sanctions? Finally, can performance be measured in a way that is fair to all school systems despite strong disparities of wealth, community mores, and geographic location?

The present study addresses only the last of these questions. It examines the Kentucky accountability index scores for public school districts during two biennia, 1992-94 and 1994-96. The purpose of the analysis is to find out the extent to which external contextual effects bias the scores and thus detract from their usefulness as measures for accountability. The issue is that teachers and school administrators should not be held accountable for socioeconomic factors that influence student performance but are beyond the control of school personnel. If such contextual effects are discovered to bias the accountability scores, the system is unfair.

Research on Contextual Effects and Educational Outcomes

In this study, the term "contextual effects" refers to factors in the social environment of a school district which influence student performance on the accountability test. Contextual effects are external to the schools and are not subject to the direct control of teachers and administrators. Studies showing that contextual effects do indeed influence educational outcomes are not new. Equality of Educational Opportunity (Coleman *et al.* 1966) reached the (at the time surprising and highly controversial) conclusion that much variation in student performance was not the result of differences between schools but was due instead to the disparate family and community backgrounds of students. Since this watershed study, many studies (for instance, Coleman 1988, 1990; Hallinan 1988; Schneider and Coleman 1993; Smith, Beaulieu, and Israel 1992; Teachman, Carver, and Paasch 1997) have reaffirmed the importance of contextual effects.[2] Many of these studies have employed large national probability samples of students such as the High School and Beyond Database and the National Educational Longitudinal Study Database. One pre-KERA study in Kentucky noted the effect of economic deprivation on school district performance (Guskey and Kifer 1990). To date, most of the research has focused on how student achievement varies with the family's socioeconomic circumstances and social capital resources.[3] The issue of

[2]Effective schools research commonly employs family SES indicators to capture external factors that influence learning (Hanushek 1997; Lee, Smith, and Croninger 1997; Zigarelli 1996).

[3]James Coleman (1988, 1990) introduced the idea of "social capital" to embrace a set of factors that must be considered when explaining student outcomes. These factors included

how community-level factors affect educational outcomes is less studied, but examples of this type of research do exist (Crane 1991; Garner and Raudenbush 1991).

The objective of the present study is to contribute to the growing body of research-based literature that examines contextual effects and educational outcomes. For reasons discussed below, this study focuses on how community context affects school district accountability index scores. With caution the results can be extrapolated to schools.

Method

The analysis uses a multivariate technique known as repeated measures general linear modeling. Multivariate analysis has one great disadvantage: lay people have difficulty understanding it. Nevertheless, simple cross-tabulations and correlations are inadequate to address the problem of contextual effects and the fairness of the accountability scores. A likely consequence of using these simpler methods would be to exaggerate the importance of contextual effects. Therefore, a multivariate approach offers a more demanding test of these effects.

Dependent Variables

Accountability index scores are calculated annually for each school and school district in the state and derive in part from tests administered to fourth, eighth, and twelfth graders[4] and in part from noncognitive criteria, including attendance, retention, dropout, and transition to adult life. Under KERA, greater attention has been devoted to school performance than to district

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norms, socialization processes, and social structures within the family and within the community that enable children to be successful in school.

[4]Problems with twelfth graders' lack of incentive to take the tests has prompted a change in which the cognitive tests are administered to eleventh graders instead of twelfth graders. Writing portfolios are still collected from twelfth graders. This change in the testing procedures was made in the 1993-94 school year.

performance. Therefore, the most germane point of attack would be to investigate if contextual effects influence school performance. Unfortunately, good measures of school-level contextual effects are not available. Several measures often used to suggest contextual effects are really student body characteristics--for example, the percent of students receiving free and reduced-cost lunch or the percent of minority students enrolled in the school. It is doubtful that either of these measures accurately represents the composition of the communities in which the schools are found. Characteristics of the schools themselves are even less satisfactory as measures of contextual effects. Per student spending, size of enrollment, and teacher-student ratio--to name some common examples--are partly controlled by the school administration, possibly with community input, and partly controlled by the district and the State.

Compared with the fuzzy measures of contextual effects that are available for schools, good measures for the contextual effects within school districts can be found in census reports and similar sources. These data accurately represent characteristics of the local population. The focus of this study, therefore, is on school districts and using district accountability scores as the dependent variables. In addition, contextual effects on grade-level scores within districts will be looked into. If the results of the district-level analyses are sufficiently strong and if the grade-level analyses support the district-level analyses, one can also make inferences about contextual effects on the school level.

School District Accountability Index Scores. In Kentucky, the margin of improvement in student scores during one two-year period compared with the preceding period determines accountability. These biennial weighted mean scores are less volatile and more reliable than single-year scores. The first set of dependent variables used in this study consists of the 1992-94 and 1994-96 weighted mean scores for each school district.

Grade-Level Accountability Index Scores by School District. Using grade-level scores as a second set of dependent variables allows testing for corroboration with the overall district-level results. This analysis will also give insight into the contextual effects at a level of aggregation that more closely approximates schools. Two-year simple mean scores for each grade level were constructed from the annual scores provided by the Kentucky Department of Education. For example, a 1992-94 fourth-grade district mean score was calculated by averaging the 1992-93 and 1993-94 fourth-grade mean scores. Since the resulting biennial mean has not been weighted by grade enrollment, measurement error may occur. However, the assumption is made that grade enrollments will not change enough from the first academic year to the second to invalidate this estimate of the biennial grade-level performance. The grade-level mean scores that were calculated in this manner represent the same two biennial periods as the district scores.

Contextual Effects

The objective was to choose a mix of contextual effects including an SES measure, such as household income, and also geographic and demographic characteristics of the county associated with each school district. A measure of the strength of local norms that encourage commitment toward schooling was sought as well.

Fixed effect. In the analyses that follow, the "rural-metro index" measures the combined effects of geographic location and population concentration. These factors are considered to have an important bearing on educational outcomes. Many studies have documented that student performance is lower in rural than in urban and suburban areas. Sizeable concentrations of populations offer greater amenities and resources than can be mustered in small towns and rural districts. Other things being equal, larger population concentrations make it easier to deliver educational programs and services (De Young 1991; Marino 1995; Stern 1994).

The rural-metro index (RM_INDEX) was constructed by recoding the USDA Economic Research Services' 1993 Urban Influence Codes. The Urban Influence Codes classify all U.S. counties into 9 categories based on the size of the Metropolitan Statistical Area for metro counties, and adjacency to MSA's and size of the largest city for nonmetro counties. To calculate the index used in the present study, the first two categories of the Urban Influence Codes, which differentiated small from large metropolitan areas, were collapsed. The next four categories were also collapsed into one category. These four categories differentiated counties adjacent to small versus large MSA's by the size of their largest town or city. The remaining categories of the Urban Influence Codes were left as is. Thus, the index used in this study has five categories, scaled from 1 to 5 with metro counties being highest. The resulting rural-metro index (see Table 1 and Figure 1) enables a comparison of the performance results of school districts in each category.[5] In the general linear models below, the index is a fixed effect rather than a covariate like the remaining independent variables. The reason for this is that there is a nonlinear relation between the rural-metro index and the accountability scores, as will be seen.

Covariates. The remaining contextual effect variables enter the general linear model as covariates. First, after some alternatives were considered, median family income for the school

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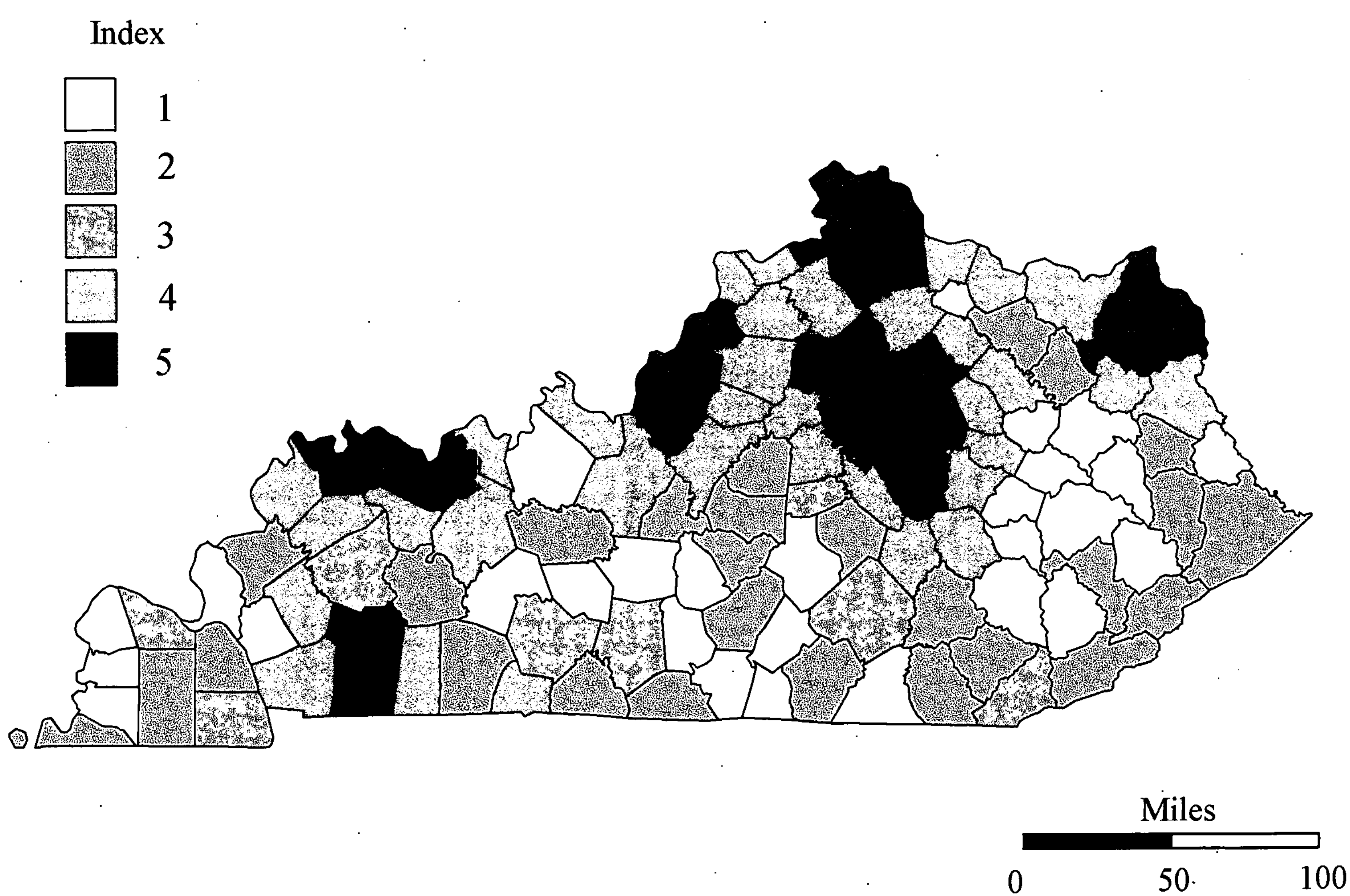
[5]The analyses described in this paper were also done using the original Urban Influence Codes. The results of this unreported analysis were very similar to what is reported here except that the rural-metro contrasts were somewhat obscured due to the larger number of ranked categories. The results will be made available on request.

Table 1. The Rural-Metro Index

Code	Description
1	Nonmetro counties not adjacent to a metro area and with no city or a city with a population less than 2,500
2	Nonmetro counties not adjacent to a metro area and with a city of 2,500 to 9,999 population
3	Nonmetro counties not adjacent to a metro area and with a city of 10,000 or more
4	Nonmetro counties physically adjacent to an MSA with at least 2 percent of the employed labor force in the county commuting to the metro area
5	Metro counties (located in an MSA)

Figure 1. Kentucky Counties by Rural-Metro Index



district was chosen to measure the socioeconomic context.[6] This measure is based on a special run of the 1990 U.S. Census data and was obtained from the School District Data Book (National Center for Educational Statistics). Median family income is directly related to the rural-metro index scale (Table 2).

The second covariate is the county teen birth rate in 1992-94.[7] This variable was chosen as a proxy, or indirect measure, for the strength of local community norms supporting educational achievement and persistence. A high teen birth rate suggests a community in which school achievement and completion is not a priority for many youths and their parents. Teen birth rate is inversely related to the rural-metro index scale and median household income (Table 2).

The last covariate is a dummy variable that indicates the school district is independent. Besides the 120 county school districts in Kentucky, there are 56 independent school districts. These independent districts are enclaves within 40 counties. The most independent districts that any county has are six. Thirty of the counties have only one independent district. A preliminary analysis of the district scores found that the independent districts outperform the county districts. Although the median family income and teen birth rate in the independent districts do not differ from the county districts, the independent districts are distributed unequally across the rural-metro spectrum. Independent districts are least likely to be found in rural counties with city populations

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[6]Other prospective variables were considered, such as the income gini coefficient for each district, percent of the adult population with a high school degree, and racial heterogeneity of the population. The first two variables were related to the dependent variables in zero-order correlations but plunged to insignificance in multivariate analyses that also included median household income. Racial heterogeneity was not related to the independent variables even in zero-order correlations.

[7]The teen birth rate is the number of births per 1,000 females, aged 12 to 17 years. These data were taken from the 1995 Kentucky KIDS COUNT.

Table 2. Breakdown of the Number of School Districts and the Covariates by Rural-Metro Index Codes

Rural-Metro Index Code	Number of School Districts	Median Household Income	Teen Birth Rate	Independent School Districts
1	30	$15,026	22.8	2
2	41	$16,952	23.5	14
3	19	$18,678	22.2	11
4	44	$20,577	18.9	10
5	42	$27,602	18.5	19
Total	176	$20,258	20.9	56

less than 2,500. They are most common in rural counties with cities having populations greater than 10,000, and are next most common in metro counties (Table 2). Being smaller and more geographically compact than the county school districts, independent districts probably reap administrative efficiencies from less bureaucracy, lower transportation costs, and a stronger organizational culture. Another advantage of independent districts may be that they garner stronger support from their local communities than do county school districts. In Coleman's (1990) terminology, they may benefit from a greater stock of "social capital." Since the presence of independent districts could confound the tests of the contextual effects, the analyses include this variable as a control.

Analyses

Contextual effects can impact district performance measures in two basic ways. First, the effects can influence progress or the lack of it within each school district. That is to say, because of adverse contextual effects some districts could have their ability to improve inhibited. Other districts because of beneficial contextual effects could receive a boost in performance. The discovery of a finding like this would be a blow to Kentucky's educational reform effort. One of KERA's guiding principles is that all schools and school districts (and all students) can significantly improve their performance, no matter what their advantages or disadvantages. Between-districts comparisons of performance are a second way to show the consequences of contextual effects for accountability scores. Districts with adverse contexts would score lower than districts with beneficial contexts, although the lower scoring districts might still show improvement compared with their own previous efforts. Since the State allocates rewards and sanctions according to how well a district or school performs compared with its previous benchmark, between-districts comparisons are less of a concern for Kentucky's accountability initiative. Nevertheless, the news media uses the accountability index scores to compare and rank districts as well as schools. The discovery that contextual effects bias such comparisons could serve to inform the media and the public of the danger of using simplistic methods of comparison.

Longer term, there is a possibility that contextual effects do influence within-districts scores. This would be a concern, since all schools and school districts are expected to attain a standard of proficiency within twenty years. Contextually disadvantaged schools and districts could fall far short of attaining the desired standard of proficiency even if their scores have been increasing regularly.

Repeated Measures General Linear Modeling

Repeated measures analysis is appropriate when measurement is made more than once on each subject or case. The procedure produces two distinct types of models. One model employs between-subjects factors and the other employs within-subjects factors. A within-subjects factor is any factor that distinguishes measurements made on the same subject or case rather than distinguishing different subjects or cases. In the analysis below, the factor labeled WDS (within-district scores) was created to distinguish the 1992-94 and 1994-96 scores for each district. The within-districts model then tests for differences between each district's two-year mean scores and uses interaction terms to estimate the effect of each of the contextual variables on these same within-district differences in scores. The between-subjects model, by contrast, divides the sample of subjects or cases into discrete subgroups related to the fixed effect, which in the present study is the rural-metro index. The index divides the 176 school districts into five mutually exclusive groups. The tests of the between-districts effects estimate regression parameters for the contextual variables on the differences in scores across districts.

Proper use of repeated measures analysis requires that one satisfy two assumptions: first, that the observed covariance matrices of the within-subjects dependent variables are equal across the groups; second, that the variance of each dependent variable is homogeneous across the groups for the between-subjects analysis. If these assumptions are not met, transforming the dependent variables will sometimes fix the problem. Because these assumptions were violated in the present study, it was necessary to convert the raw district scores to natural logarithms. Once this transformation of the dependent variables was done, the assumptions were satisfied and the analysis went forward.

Results

Analysis of District Scores

Within-Districts Model. Between the biennia of 1992-94 and 1994-96 the overall mean accountability score for the entire state increased from 39.3 to 44.6 (an increase of 13.5 percent). If the interest of this study were solely to find out if this meant that the within-district scores had significantly improved, the repeated measures general linear model would not be necessary. A paired sample *t*-test to compare the difference between the means would suffice. But it is not enough simply to discover if the scores have increased. It is also important to find out what differences (if any) the contextual effects contribute to the differences in the scores. The tests of within-districts effects (Table 3) do this. The interaction terms reveal whether the contextual effects influence the analysis of variance. Clearly, median household income is the only contextual effect that contributes to variation in the within-districts scores. The eta squared value indicates that the size of this effect is small, since it explains only 3.3 percent of the variation. Contextual

Table 3.. Tests of Within-Districts Effects

Source	df	F	Sig.	Eta Squared
WDS	1	39.090	.000	.189
WDS * MEDHHINC	1	5.817	.017	.033
WDS * TEENBRTH	1	.861	.355	.005
WDS * INDISTR	1	1.659	.200	.010
WDS * RM_INDEX	4	1.257	.289	.029
Error(WDS)	168			

Table 4. Parameter Estimates of Between-Districts Effects

Dependent Variable	Parameter	B	Std. Error	t	Sig.	Eta Squared
1992-94 district score (log)[a]	Intercept	3.510	.042	83.423	.000	.
	MEDHHINC	8.421E-06	.000	7.910	.000	.271
	TEENBRTH	-3.856E-03	.001	-3.561	.000	.070
	INDISTR	5.442E-02	.014	3.791	.000	.079
	[RM_INDEX=1]	5.576E-02	.025	2.249	.026	.029
	[RM_INDEX=2]	7.669E-02	.022	3.541	.001	.069
	[RM_INDEX=3]	9.012E-02	.025	3.635	.000	.073
	[RM_INDEX=4]	4.132E-02	.020	2.091	.038	.025
	[RM_INDEX=5]	0[c]	.	.	.	.
1994-96 district score (log)[b]	Intercept	3.677	.044	83.928	.000	.
	MEDHHINC	6.683E-06	.000	6.028	.000	.178
	TEENBRTH	-3.176E-03	.001	-2.817	.005	.045
	INDISTR	4.190E-02	.015	2.803	.006	.045
	[RM_INDEX=1]	1.949E-02	.026	.755	.451	.003
	[RM_INDEX=2]	6.330E-02	.023	2.807	.006	.045
	[RM_INDEX=3]	7.229E-02	.026	2.800	.006	.045
	[RM_INDEX=4]	2.650E-02	.021	1.288	.200	.010
	[RM_INDEX=5]	0[c]	.	.	.	.

a. Adjusted R-square = .423

b. Adjusted R-square = .331

c. This parameter is set to zero because it is redundant.

effects, therefore, have little to no impact on within-districts scores.[8]

Between-Districts Model. It is also important to know if the contextual effects influence the differences in scores between districts. On this point, the answer is a resounding yes. The parameter estimates for the between districts model (Table 4) show that, after controlling for the possibly confounding influence of independent districts, all the contextual measures are significant. Median household income is the strongest predictor of higher scores in both biennia, while teen birth rate has a negative effect, as expected. The rural-metro index has a nonlinear relationship with the scores. In 1992-94, the first four categories of the rural-metro index are positive in their effects. Since metro counties are the reference category, this means that metro school districts are outperformed by all other types in this biennium. Furthermore, rural counties with cities having populations greater than 2,500 perform better than all others. In 1994-96, rural counties whose cities are greater than 2,500 in population again outperform all other types. However, metro school districts do about as well as districts in metro adjacent counties and rural counties having cities with populations less than 2,500 in this biennium.

In a multivariate test of between-districts effects that averaged the results from both biennia (not shown), the eta squared values were: median household income (0.244), teen birth rate (0.063), independent district (0.067), and rural-metro index (0.090). Thus, rural-metro differences rank second in overall importance behind median household income.

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[8]This conclusion was supported by two other analyses not reported here: First, the difference in the within-districts scores for the two biennia was regressed on the same group of independent variables. No effects were found. Second, districts receiving rewards versus districts not receiving rewards in 1994 and in 1996 were regressed on the independent variables. Again, the contextual effects were not significant in these logistic regression equations. The results of these analyses are available on request.

How well the between-districts models predict the scores can be judged from the adjusted R-square values. The 1992-94 model explains 42 percent of the variance in scores. In the following biennium, the explained variance drops to 33 percent. Whether this decline in the importance of the contextual effects portends a real trend cannot be decided from only two biennia of performance data.

A graphical presentation (Figure 2) illustrates these findings in a more striking way. The graph contrasts the actual biennial mean scores with the mean scores predicted by the between-districts model,[9] after segmenting the scores by the rural-metro categories. The graph shows that when the effects of median household income, teen birth rate, and independent school districts are held constant, the more rural school districts do better than suggested by their actual mean scores, while metro districts do considerably worse. No explanation of this finding is possible using the data available. However, one may suppose that if independent school districts have an advantage because of their smaller size and greater social capital, similar advantages may accrue to rural school districts once the disadvantages of low household income and high teen birth rate are controlled.[10] The graph also makes it clear that nonmetro counties with larger towns and metro adjacent counties are the least affected by median household income and teen birth rate.

Outliers. The general linear model will produce a predicted biennial mean[11] and a

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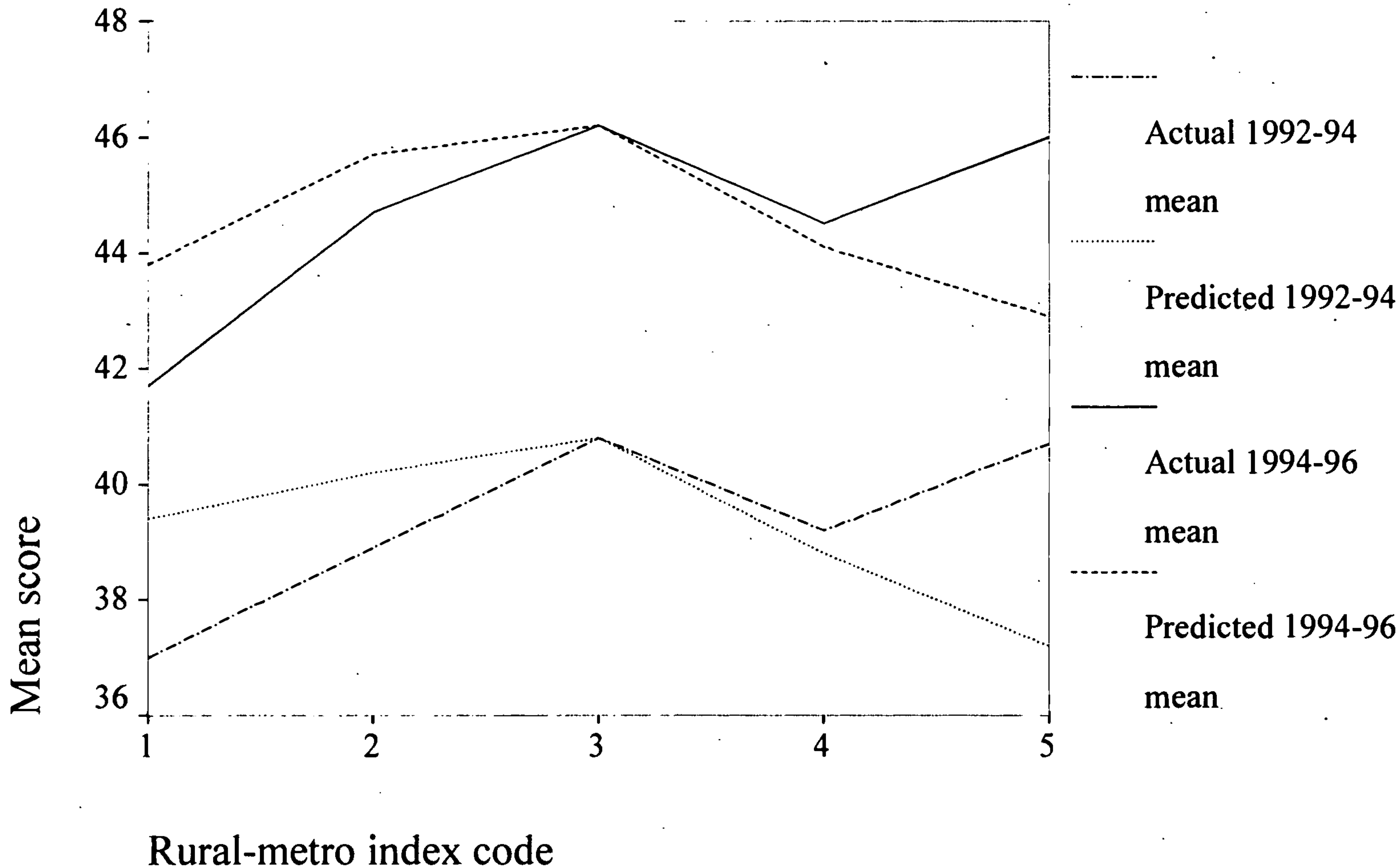
[9]The general linear model generated a predicted mean score for each district, expressed in a natural logarithm. The exponential function was then used to rescale the predicted scores and make them comparable with the actual mean scores.

[10]See Stern (1994: chap. 9) for a discussion of this and related issues.

[11]Again, the exponential function was used to rescale the logarithmic means and make them comparable with the actual means.

Figure 2. Actual and Predicted Mean Scores by Rural-Metro Index Codes



standardized residual for each school district (see the Appendix for the complete list). The standardized residual tells how much the district's actual mean score deviates from that predicted by the between-districts model. School districts with standardized residuals that are equal to or greater than 2 or that are equal to or less than - 2 are termed "outliers." When z-residual ≥ 2, the district is performing better than expected. When z-residual ≤ -2, the district is performing worse than expected. An examination of the outliers may give clues why these cases are exceptional.

Seventeen school districts are outliers in one or both biennia (Table 5), and the negative outliers slightly outnumber the positive ones. The outliers are distributed across all rural-metro categories. What is most striking about the outliers is that, without exception, they are independent school districts. Why this should be is problematic. It has been suggested that independent districts are advantaged compared with county districts. On average, they have higher accountability scores. But an inspection of the outliers reveals an important exception to this. In a little more than 10 percent of the independent districts, accountability scores are less than expected when compared with other districts, after correcting for the contextual effects. Three of the independent districts are negative in both biennia. However, every negative outlier showed an increase in score between the first and the second biennium. Therefore, it is only when compared with other school districts that these districts appear to perform below par.

No explanation for why only independent districts are outliers can be directly gleaned from the data used in this study. Perhaps their smaller size and geographic compactness may provide a clue for explaining this finding. Smaller school districts may have more homogeneous student populations and community environments. Depending on whether the local context helps or

Table 5. Outliers from Between-Districts Analyses

District Name	Rural-Metro Index	1992-94	1994-96
Augusta Ind.	4	-	
Cloverpoint Ind.	1		-
Covington Ind.	5	-	-
Dayton Ind.	5	-	
Fairview Ind.	5		-
Ft. Thomas Ind.	4		+
Jenkins Ind.	2	-	-
Middlesboro Ind.	3	-	
Murray Ind.	3	+	
Newport Ind.	5	-	-
Paintsville Ind.	2	+	
Pikeville Ind.	2		+
Providence Ind.	4		-
Science Hill Ind.	2	+	
Southgate Ind.	5	+	
West Point Ind.	4		-
Williamsburg Ind.	2	+	+

- = observed score is significantly less than the predicted score.
+ = observed score is significantly greater than the predicted score.
[blank] = district is not an outlier in the biennium.

hinders student learning, this homogeneity can have either sharply positive or negative consequences.

Analysis of Grade-Level Scores by District

This study focuses on district accountability scores because good measures of contextual effects are available at this level of aggregation. The results cannot simply be extrapolated to the school level without danger of aggregation bias. Nevertheless, because mean scores for grades 4, 8, and 12 in each district are available, these data allow testing the presence of contextual effects on different grade levels both within and between districts. While not a school-level analysis as such, it gives a closer approximation than the previous tests. The grade-level analyses will also reveal how the contextual effects vary by grade.

Grade 4. The within-districts tests at the fourth grade (WDS_04) level (Table 6) show that scores have improved during the two biennia without any influences from the contextual effects. Between-districts effects (Table 7) are weak at this grade level. Median household income is the only contextual effect that is significant in both biennia, and the strength of this effect in 1994-96 is half what it was in 1992-94. Neither teen birth rate nor rural-metro differences have important consequences for primary school performance.

Grade 8. The within-districts tests at the eighth grade level (Table 8) show an improvement in accountability scores during the two biennia, although the increase is less at this grade level than for fourth graders. Again, contextual effects do not contribute to this increase in the scores. The grade 8 between-districts effects (Table 9) are more pronounced than in the fourth grade. Median household income, teen birth rate, and rural-metro differences are all significant. The metro school districts fare less well than most of the other rural-metro categories.

Table 6. Tests of Grade 4 Within-Districts Effects

Source	df	F	Sig.	Eta Squared
WDS_04	1	35.592	.000	.175
WDS_04 * MEDHHINC	1	3.320	.070	.019
WDS_04 * TEENBRTH	1	.029	.865	.000
WDS_04 * INDISTR	1	.044	.833	.000
WDS_04 * RM_INDEX	4	.880	.477	.021
Error(WDS_04)	168			

Table 7. Parameter Estimates of Grade 4 Between-Districts Effects

Dependent Variable	Parameter	B	Std. Error	t	Sig.	Eta Squared
1992-94 grade 4 district score (log)[a]	Intercept	3.468	.057	60.319	.000	
	MEDHHINC	7.495E-06	.000	5.152	.000	.136
	TEENBRTH	-7.451E-04	.001	-.504	.615	.002
	INDISTR	7.416E-03	.020	.378	.706	.001
	[RM_INDEX=1]	2.767E-02	.034	.817	.415	.004
	[RM_INDEX=2]	4.484E-02	.030	1.516	.132	.013
	[RM_INDEX=3]	7.823E-02	.034	2.310	.022	.031
	[RM_INDEX=4]	3.260E-02	.027	1.208	.229	.009
	[RM_INDEX=5]	0[c]	.	.	.	.
1994-96 grade 4 district score (log)[b]	Intercept	3.723	.062	59.892	.000	
	MEDHHINC	5.395E-06	.000	3.430	.001	.065
	TEENBRTH	-5.452E-04	.002	-.341	.734	.001
	INDISTR	4.140E-03	.021	.195	.845	.000
	[RM_INDEX=1]	-1.816E-02	.037	-.496	.621	.001
	[RM_INDEX=2]	2.324E-02	.032	.726	.469	.003
	[RM_INDEX=3]	4.135E-02	.037	1.129	.261	.008
	[RM_INDEX=4]	9.253E-03	.029	.317	.752	.001
	[RM_INDEX=5]	0[c]	.	.	.	.

a. Adjusted R-square = .156

b. Adjusted R-square = .086

c. This parameter is set to zero because it is redundant.

Table 8. Tests of Grade 8 Within-Districts Effects

Source	df	F	Sig.	Eta Squared
WDS_08	1	8.121	.005	.046
WDS_08 * MEDHHINC	1	2.533	.113	.015
WDS_08 * TEENBRTH	1	.276	.600	.002
WDS_08 * INDISTR	1	1.927	.167	.011
WDS_08 * RM_INDEX	4	.600	.663	.014
Error(WDS_08)	168			

Table 9. Parameter Estimates of Grade 8 Between-Districts Effects

Dependent Variable	Parameter	B	Std. Error	t	Sig.	Eta Squared
1992-94 grade 8 district score (log)[a]	Intercept	3.532	.053	66.080	.000	
	MEDHHINC	8.851E-06	.000	6.545	.000	.203
	TEENBRTH	-5.335E-03	.001	-3.879	.000	.082
	INDISTR	4.607E-02	.018	2.527	.012	.037
	[RM_INDEX=1]	7.224E-02	.031	2.294	.023	.030
	[RM_INDEX=2]	.115	.028	4.181	.000	.094
	[RM_INDEX=3]	.103	.031	3.282	.001	.060
	[RM_INDEX=4]	6.149E-02	.025	2.450	.015	.034
	[RM_INDEX=5]	0[c]	.	.	.	.
1994-96 grade 8 district score (log)[b]	Intercept	3.643	.054	67.630	.000	
	MEDHHINC	7.106E-06	.000	5.214	.000	.139
	TEENBRTH	-4.749E-03	.001	-3.426	.001	.065
	INDISTR	2.555E-02	.018	1.390	.166	.011
	[RM_INDEX=1]	4.245E-02	.032	1.337	.183	.011
	[RM_INDEX=2]	.114	.028	4.122	.000	.092
	[RM_INDEX=3]	.102	.032	3.229	.001	.058
	[RM_INDEX=4]	6.014E-02	.025	2.377	.019	.033
	[RM_INDEX=5]	0[c]	.	.	.	.

a. Adjusted R-square = .318

b. Adjusted R-square = .253

c. This parameter is set to zero because it is redundant.

Grade 12. A paired samples *t*-test shows a significant difference in the grade 12 within-districts scores ($t = 15.099$, df =170, $p = .000$), but the inclusion of the contextual effects in the multivariate model (Table 10) renders the difference in the means insignificant. Yet, none of the contextual effects is significant. Thus, although contextual effects do exert an influence on the twelfth-grade change in scores, the source of the influence cannot be pinpointed.[12]

Between-districts effects are the most pronounced at the twelfth grade (Table 11), and the results most closely approximate the overall district results described previously. Twelfth graders in metro and metro adjacent school districts perform less well than in rural districts, and teen birth rate is a negative influence. A noticeable departure from previous findings is that the effect of the independent school district is stronger in the twelfth grade than in the lower grades. Furthermore, the effect of the independent district on twelfth-grade performance lessens the size of the median household income effect. This suggests that administrative and social capital advantages associated with independent districts may have a greater influence on twelfth-grade scores, to the extent of partially overriding the importance of income. This is an issue that deserves more thorough investigation.

Implications

The present study analyzed Kentucky school district accountability index scores for the 1992-94 and 1994-96 biennia. Repeated measures general linear modeling was used to create two types of tests of contextual effects on the scores. The first type of test was for within-districts differences in the scores, incorporating the contextual effects as interaction terms. The

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[12]The inclusion of median household income and teen birth rate together in the multivariate model is necessary to make the changes in the within-districts means insignificant.

Table 10. Tests of Grade 12 Within-Districts Effects

Source	df	F	Sig.	Eta Squared
WDS_12	1	1.708	.193	.010
WDS_12 * MEDHHINC	1	.072	.789	.000
WDS_12 * TEENBRTH	1	1.106	.294	.007
WDS_12 * INDISTR	1	.634	.427	.004
WDS_12 * RM_INDEX	4	.138	.968	.003
Error(WDS_12)	163			

Table 11. Parameter Estimates of Grade 12 Between-Districts Effects

Dependent Variable	Parameter	B	Std. Error	t	Sig.	Eta Squared
1992-94 grade 12 district score (log)[a]	Intercept	3.497	.067	52.121	.000	
	MEDHHINC	9.791E-06	.000	5.210	.000	.143
	TEENBRTH	-5.104E-03	.001	-3.807	.000	.082
	INDISTR	.125	.018	7.095	.000	.236
	[RM_INDEX=1]	7.112E-02	.032	2.240	.026	.030
	[RM_INDEX=2]	6.804E-02	.027	2.536	.012	.038
	[RM_INDEX=3]	8.350E-02	.030	2.793	.006	.046
	[RM_INDEX=4]	3.239E-02	.024	1.350	.179	.011
	[RM_INDEX=5]	0[c]	.	.	.	.
1994-96 grade 12 district score (log)[b]	Intercept	3.574	.074	48.598	.000	
	MEDHHINC	1.030E-05	.000	5.001	.000	.133
	TEENBRTH	-3.678E-03	.001	-2.503	.013	.037
	INDISTR	.111	.019	5.739	.000	.168
	[RM_INDEX=1]	6.370E-02	.035	1.831	.069	.020
	[RM_INDEX=2]	7.352E-02	.029	2.500	.013	.037
	[RM_INDEX=3]	8.708E-02	.033	2.658	.009	.042
	[RM_INDEX=4]	2.377E-02	.026	.904	.367	.005
	[RM_INDEX=5]	0[c]	.	.	.	.

a. Adjusted R-square = .417

b. Adjusted R-square = .335

c. This parameter is set to zero because it is redundant.

second type of test looked at the influence of the contextual effects on between-districts scores. Both types of tests were run on the overall district mean scores and on grade-level scores by district, and produced strikingly dissimilar results. Contextual effects had little impact on the variation in within-districts scores. This generalization holds for both the overall district mean scores and the grade-level scores. The main exception was found in the grade 12 scores where the contextual effects washed out the increase in the scores across the two biennia. These results support the view that *Kentucky's accountability index scores are not seriously biased by contextual effects for short-term assessment. On the other hand, when 30-40 percent of the variation in between-districts scores is accounted for by contextual effects, district-to-district comparisons cannot be fairly made without first adjusting for these effects.*

The grade-level analyses generally supported the analysis of the districts as a whole. The contextual effects were found to increase with the grade level in the between-districts models. Since the grade-level analysis approximates a school-level analysis, these results offered a basis for cautious extrapolation of the findings to schools. The findings suggest that, in comparisons between schools, elementary schools are less influenced by contextual effects than either middle or high schools. However, this is a conclusion that needs more study.

The study findings have something to say about an issue recently debated in the press. On December 10, 1997, a front-page article in the Lexington Herald-Leader, reported on a proposal made by the Office of Education Accountability (OEA). The proposal called for changing the way accountability scores are evaluated. To increase the fairness of the accountability system, the OEA recommended that school scores be adjusted for certain factors that affect school performance. Among these factors were student poverty rates, education level of parents, per pupil spending, class and school size, teacher salaries, and the district's tax rate.[13] The Director of the Prichard Committee for Academic Excellence and the Lexington Herald-Leader in an editorial quickly condemned the proposal. Although the present study does not look at contextual effects on school performance *per se*, its findings may serve to moderate the concerns of parties on both sides of this controversy. *No harm will come from adjusting scores to make the accountability procedures fairer. Still, these adjustments may not make much difference if the main focus of accountability remains on short-term improvements within schools and within districts.*

The present study has implications for the practice of ranking schools and districts. *The results strongly suggest that the news media should refrain from ranking districts and schools based on their actual accountability index scores.*[14] Comparing districts (and probably schools) in this manner is biased and can seriously mislead the public and policy makers.[15] It may also harm the self-esteem of educators, students, and parents in disadvantaged districts. In the interest of fairness and to ensure accurate perceptions, scores should be adjusted for contextual effects before rankings and comparisons are made. This recommendation is especially important for comparisons and rankings of middle schools and high schools.

A crucial question remains which the findings of this study cannot answer: How will contextual effects influence the improvement potential of districts and schools over a longer span of time? It is conceivable that districts can improve their scores from one biennium to the next

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[13]It should be obvious that this list contains both contextual effects and factors which are to some degree controlled by the school district administration.

[14]See, for example, the report of school and district accountability index scores with rankings in Section B of the December 5, 1997 issue of the Lexington Herald-Leader.

[15]Guskey and Kifer (1990) reached the same conclusion in their pre-KERA study.

but that the rate of improvement will decline for disadvantaged districts compared with the advantaged ones. This idea cannot be tested until performance scores for more than two biennia become available. The first opportunity to make such a test will be when the third biennium's data become available later this year.

If it should happen that continuing research substantiates a decline in the importance of contextual effects, this would offer dramatic confirmation that KERA is benefitting children's learning across the state. The suppression of contextual effects would mean that educational outcomes are becoming more equal, achieving one of KERA's primary goals.

Conclusion

Repeated measures general linear modeling has proven to be an appropriate method for assessing the two principal ways in which contextual effects may bias the accountability index scores. First, bias may affect test scores within educational units across successive biennia. Second, bias may occur when comparing test scores across units. Taken together these paired analyses are well suited for assessing if KERA's system of accountability testing contributes to greater equality of educational opportunity for Kentucky's students. The present study has not found evidence to seriously fault KERA's method of within-districts and within-schools assessment. On the other hand, comparisons between districts (and presumably between schools) are quite sensitive to contextual effects. This is an important finding because the media have frequently made such comparisons. The between-districts analyses also heighten the concern that substantial long-term improvement could be an unrealistic goal for disadvantaged school districts without the enhancement of local community resources. A longer period to monitor the influence of contextual effects on the accountability scores will clarify this issue.

Appendix

For each biennium and school district the Appendix lists (1) the name of the district, (2) the rural-metro index code, (3) the actual biennium mean score, (4) the predicted biennium mean score obtained from the repeated measures analysis, and (5) the standardized residual.

DISTRICT NAME	RM INDEX	Actual 1992-94 mean	Predicted 1992-94 mean	Z-residual
ADAIR CO	2	37.9	37.8	.03
ALLEN CO	2	37.0	38.8	-.56
ANCHORAGE IND	5	63.8	64.1	-.06
ANDERSON CO	4	41.1	41.6	-.14
ASHLAND IND	5	41.0	39.5	.45
AUGUSTA IND	4	33.7	39.8	-2.01
BALLARD CO	1	37.3	38.6	-.42
BARBOURVILLE IND	2	38.5	37.1	.45
BARDSTOWN IND	4	39.1	42.6	-1.04
BARREN CO	3	36.1	40.8	-1.47
BATH CO	4	33.9	35.1	-.42
BEECHWOOD IND	5	52.0	45.7	1.57
BELL CO	3	38.8	36.1	.88
BELLEVUE IND	5	35.2	40.7	-1.75
BEREA IND	5	42.2	38.8	1.03
BOONE CO	5	41.3	43.3	-.57
BOURBON CO	5	37.8	39.7	-.59
BOWLING GREEN IND	3	37.5	41.6	-1.24
BOYD CO	5	37.4	38.9	-.48
BOYLE CO	3	41.7	43.4	-.48
BRACKEN CO	4	38.7	38.4	.10
BREATHITT CO	1	31.8	34.3	-.93
BRECKINRIDGE CO	1	38.2	38.9	-.21
BULLITT CO	5	36.9	40.3	-1.05
BURGIN IND	4	40.6	43.2	-.75
BUTLER CO	1	38.8	36.9	.59
CALDWELL CO	4	37.7	36.8	.28
CALLOWAY CO	3	45.9	41.3	1.28
CAMPBELL CO	5	40.9	41.9	-.28
CAMPBELLSVILLE IND	2	40.7	40.4	.07
CARLISLE CO	1	41.4	39.8	.47
CARROLL CO	4	37.7	37.9	-.07
CARTER CO	5	35.5	35.2	.09
CASEY CO	1	34.5	36.9	-.80
CAVERNA IND	3	38.7	41.1	-.72
CHRISTIAN CO	5	34.7	35.2	-.18
CLARK CO	5	39.8	37.9	.60
CLAY CO	1	34.0	35.2	-.42
CLINTON CO	1	34.6	35.2	-.20
CLOVERPORT IND	1	35.4	39.3	-1.27
CORBIN IND	2	41.9	41.1	.24
COVINGTON IND	5	31.7	38.8	-2.45
CRITTENDEN CO	2	40.1	40.2	-.03
CUMBERLAND CO	1	39.0	36.5	.80
DANVILLE IND	3	41.6	44.0	-.67
DAVIESS CO	5	41.8	39.7	.62

DISTRICT NAME	RM INDEX	Actual 1992-94 mean	Predicted 1992-94 mean	Z-residual
DAWSON SPRINGS IND	3	42.7	39.8	.84
DAYTON IND	5	32.2	40.0	-2.62
EAST BERNSTADT IND	2	37.1	39.8	-.84
EDMONSON CO	1	40.3	37.3	.95
ELIZABETHTOWN IND	4	46.5	40.3	1.73
ELLIOTT CO	4	39.3	36.2	.97
EMINENCE IND	4	43.1	40.5	.75
ERLANGER-ELSMERE IND	5	41.6	42.3	-.20
ESTILL CO	4	36.5	36.4	.04
FAIRVIEW IND	5	34.4	39.5	-1.66
FAYETTE CO	5	42.9	38.9	1.17
FLEMING CO	2	37.4	39.1	-.54
FLOYD CO	2	35.4	37.2	-.60
FT THOMAS IND	4	53.4	40.3	3.39
FRANKFORT IND	4	38.6	44.0	-1.58
FRANKLIN CO	5	41.8	42.3	-.14
FULTON CO	2	34.2	37.5	-1.10
FULTON IND	2	37.4	38.6	-.38
GALLATIN CO	5	34.6	36.7	-.71
GARRARD CO	4	39.2	39.2	-.01
GLASGOW IND	3	42.0	41.7	.07
GRANT CO	5	37.7	38.5	-.27
GRAVES CO	2	39.6	39.7	-.02
GRAYSON CO	2	41.3	38.6	.80
GREEN CO	1	40.6	37.9	.83
GREENUP CO	5	40.2	37.5	.83
HANCOCK CO	4	42.3	42.1	.05
HARDIN CO	4	38.7	40.0	-.38
HARLAN CO	2	32.1	37.0	-1.72
HARLAN IND	2	38.4	38.5	-.04
HARRISON CO	4	43.9	39.6	1.24
HARRODSBURG IND	4	41.4	39.4	.59
HART CO	1	37.9	37.0	.30
HAZARD IND	2	43.6	38.9	1.38
HENDERSON CO	5	40.0	39.1	.29
HENRY CO	4	43.1	39.8	.97
HICKMAN CO	1	40.8	40.9	-.04
HOPKINS CO	3	39.2	40.4	-.37
JACKSON CO	4	33.5	35.1	-.57
JACKSON IND	1	34.4	36.1	-.59
JEFFERSON CO	5	37.8	38.1	-.09
JENKINS IND	2	33.4	40.5	-2.34
JESSAMINE CO	5	40.2	39.1	.33
JOHNSON CO	2	43.6	37.4	1.84
KENTON CO	5	43.2	42.5	.19
KNOTT CO	1	36.9	35.8	.38

DISTRICT NAME	RM INDEX	Actual 1992-94 mean	Predicted 1992-94 mean	Z-residual
KNOX CO	2	31.7	35.2	-1.26
LARUE CO	2	37.6	40.3	-.83
LAUREL CO	2	38.3	39.1	-.24
LAWRENCE CO	4	35.7	36.7	-.32
LEE CO	1	39.2	34.9	1.42
LESLIE CO	1	35.1	35.9	-.26
LETCHER CO	2	34.6	37.4	-.93
LEWIS CO	4	38.7	35.9	.90
LINCOLN CO	2	37.1	37.8	-.22
LIVINGSTON CO	1	37.2	40.5	-1.01
LOGAN CO	2	37.4	39.7	-.73
LUDLOW IND	5	42.5	39.8	.78
LYON CO	1	39.9	40.9	-.30
MADISON CO	5	38.3	37.1	.37
MAGOFFIN CO	1	37.7	35.4	.76
MARION CO	2	38.7	39.0	-.10
MARSHALL CO	2	39.8	40.9	-.32
MARTIN CO	1	36.5	36.7	-.06
MASON CO	4	38.3	38.0	.08
MAYFIELD IND	2	41.2	39.3	.57
MCCRACKEN CO	3	39.6	40.1	-.14
MCCREARY CO	1	34.9	35.6	-.22
MCLEAN CO	4	39.5	38.6	.27
MEADE CO	4	39.5	40.4	-.27
MENIFEE CO	1	36.5	38.1	-.51
MERCER CO	4	38.7	40.8	-.63
METCALFE CO	1	36.8	37.1	-.10
MIDDLESBORO IND	3	32.7	38.9	-2.10
MONROE CO	2	37.3	37.9	-.20
MONTGOMERY CO	4	38.0	37.9	.03
MONTICELLO IND	2	38.9	38.3	.18
MORGAN CO	1	40.9	36.9	1.24
MUHLENBERG CO	2	40.4	39.5	.28
MURRAY IND	3	50.2	42.4	2.03
NELSON CO	4	40.4	40.9	-.14
NEWPORT IND	5	31.8	38.4	-2.27
NICHOLAS CO	4	33.3	38.3	-1.69
OHIO CO	4	38.4	37.0	.46
OLDHAM CO	5	50.7	45.1	1.41
OWEN CO	4	38.5	38.8	-.10
OWENSBORO IND	5	39.9	38.5	.43
OWSLEY CO	1	31.3	32.8	-.55
PADUCAH IND	3	38.3	38.2	.04
PAINTSVILLE IND	2	46.3	39.1	2.04
PARIS IND	5	36.7	38.7	-.63
PENDLETON CO	5	42.6	37.5	1.55

DISTRICT NAME	RM INDEX	Actual 1992-94 mean	Predicted 1992-94 mean	Z-residual
PERRY CO	2	35.7	36.7	-.32
PIKE CO	2	35.8	38.7	-.94
PINEVILLE IND	3	36.9	36.7	.06
POWELL CO	4	38.9	37.0	.59
PROVIDENCE IND	4	33.3	38.8	-1.84
PULASKI CO	3	37.3	39.5	-.69
RACELAND IND	5	41.4	41.6	-.06
ROBERTSON CO	1	35.5	37.0	-.51
ROCKCASTLE CO	4	40.5	35.7	1.53
ROWAN CO	2	39.5	39.2	.10
RUSSELL CO	1	38.6	36.8	.58
RUSSELL IND	5	41.9	43.5	-.45
RUSSELLVILLE IND	2	44.1	40.2	1.11
SCIENCE HILL IND	3	49.8	42.2	2.00
SCOTT CO	5	40.8	38.3	.76
SHELBY CO	4	42.4	41.9	.13
SILVER GROVE IND	5	42.8	41.3	.43
SIMPSON CO	4	38.7	38.4	.08
SOMERSET IND	3	45.1	41.2	1.11
SOUTHGATE IND	5	51.6	42.8	2.27
SPENCER CO	4	36.6	39.4	-.90
TAYLOR CO	2	40.4	41.2	-.24
TODD CO	4	41.2	38.9	.69
TRIGG CO	4	38.6	38.1	.15
TRIMBLE CO	4	42.2	40.2	.58
UNION CO	4	38.8	40.5	-.50
WALTON VERONA IND	5	44.9	42.5	.66
WARREN CO	3	41.2	42.8	-.45
WASHINGTON CO	2	41.0	40.7	.09
WAYNE CO	2	36.1	36.5	-.14
WEBSTER CO	4	38.3	39.3	-.31
WEST POINT IND	4	33.3	39.2	-1.98
WHITLEY CO	2	38.0	36.4	.53
WILLIAMSBURG IND	2	50.1	38.9	3.06
WILLIAMSTOWN IND	5	39.6	38.5	.33
WOLFE CO	1	33.6	33.4	.08
WOODFORD CO	5	43.3	42.0	.36

DISTRICT NAME	RM INDEX	Actual 1994-96 mean	Predicted 1994-96 mean	Z-residual
ADAIR CO	2	41.6	43.6	-.54
ALLEN CO	2	40.3	44.4	-1.13
ANCHORAGE IND	5	63.3	66.0	-.48
ANDERSON CO	4	55.0	46.6	1.92
ASHLAND IND	5	45.9	45.0	.24
AUGUSTA IND	4	45.3	45.0	.09
BALLARD CO	1	39.6	43.1	-.99
BARBOURVILLE IND	2	41.7	42.8	-.30
BARDSTOWN IND	4	46.0	47.5	-.37
BARREN CO	3	44.4	46.2	-.46
BATH CO	4	41.9	40.7	.34
BEECHWOOD IND	5	56.2	50.4	1.25
BELL CO	3	39.2	41.9	-.76
BELLEVUE IND	5	43.9	46.0	-.55
BEREA IND	5	46.7	44.3	.62
BOONE CO	5	48.7	48.5	.06
BOURBON CO	5	43.4	45.2	-.48
BOWLING GREEN IND	3	41.9	46.9	-1.29
BOYD CO	5	46.4	44.5	.49
BOYLE CO	3	45.0	48.6	-.88
BRACKEN CO	4	41.4	43.7	-.63
BREATHITT CO	1	38.7	39.2	-.16
BRECKINRIDGE CO	1	43.6	43.4	.06
BULLITT CO	5	41.2	45.7	-1.20
BURGIN IND	4	45.3	48.0	-.66
BUTLER CO	1	43.3	41.6	.46
CALDWELL CO	4	42.9	42.3	.16
CALLOWAY CO	3	47.4	46.7	.18
CAMPBELL CO	5	44.8	47.1	-.59
CAMPBELLSVILLE IND	2	44.5	45.9	-.36
CARLISLE CO	1	48.9	44.2	1.16
CARROLL CO	4	44.0	43.3	.19
CARTER CO	5	45.3	41.1	1.13
CASEY CO	1	40.4	41.6	-.33
CAVERNA IND	3	45.7	46.4	-.18
CHRISTIAN CO	5	40.3	41.0	-.21
CLARK CO	5	46.5	43.5	.77
CLAY CO	1	40.4	40.0	.11
CLINTON CO	1	38.0	40.0	-.60
CLOVERPORT IND	1	36.7	43.7	-2.03
CORBIN IND	2	50.2	46.5	.90
COVINGTON IND	5	35.3	44.4	-2.65
CRITTENDEN CO	2	48.0	45.8	.54
CUMBERLAND CO	1	45.3	41.2	1.09
DANVILLE IND	3	46.1	49.0	-.71
DAVIESS CO	5	52.0	45.2	1.62

DISTRICT NAME	RM INDEX	Actual 1994-96 mean	Predicted 1994-96 mean	Z-residual
DAWSON SPRINGS IND	3	45.9	45.3	.17
DAYTON IND	5	38.5	45.4	-1.92
EAST BERNSTADT IND	2	45.4	45.3	.02
EDMONSON CO	1	43.5	41.9	.43
ELIZABETHTOWN IND	4	51.2	45.4	1.40
ELLIOTT CO	4	43.7	41.8	.52
EMINENCE IND	4	45.4	45.6	-.05
ERLANGER-ELSMERE IND	5	47.4	47.5	-.02
ESTILL CO	4	44.1	41.9	.60
FAIRVIEW IND	5	37.3	44.9	-2.15
FAYETTE CO	5	48.0	44.5	.88
FLEMING CO	2	39.6	44.8	-1.43
FLOYD CO	2	42.0	43.0	-.27
FT THOMAS IND	4	55.6	45.4	2.35
FRANKFORT IND	4	44.6	48.7	-1.01
FRANKLIN CO	5	47.3	47.5	-.06
FULTON CO	2	37.7	43.2	-1.58
FULTON IND	2	43.1	44.2	-.29
GALLATIN CO	5	37.9	42.4	-1.31
GARRARD CO	4	45.1	44.5	.15
GLASGOW IND	3	49.5	47.0	.60
GRANT CO	5	44.6	44.2	.12
GRAVES CO	2	47.7	45.3	.61
GRAYSON CO	2	49.1	44.3	1.18
GREEN CO	1	48.6	42.5	1.56
GREENUP CO	5	41.4	43.3	-.51
HANCOCK CO	4	45.8	47.1	-.33
HARDIN CO	4	43.2	45.1	-.51
HARLAN CO	2	36.6	42.8	-1.82
HARLAN IND	2	49.0	44.2	1.20
HARRISON CO	4	51.8	44.9	1.67
HARRODSBURG IND	4	47.4	44.6	.70
HART CO	1	43.0	41.7	.37
HAZARD IND	2	49.1	44.4	1.16
HENDERSON CO	5	47.5	44.6	.72
HENRY CO	4	45.5	45.0	.13
HICKMAN CO	1	47.5	45.2	.57
HOPKINS CO	3	45.4	45.9	-.12
JACKSON CO	4	38.0	40.7	-.80
JACKSON IND	1	41.3	40.8	.15
JEFFERSON CO	5	41.8	43.7	-.52
JENKINS IND	2	35.7	46.0	-2.93
JESSAMINE CO	5	46.2	44.7	.39
JOHNSON CO	2	49.8	43.2	1.64
KENTON CO	5	49.5	47.7	.42
KNOTT CO	1	41.1	40.6	.15

DISTRICT NAME	RM INDEX	Actual 1994-96 mean	Predicted 1994-96 mean	Z-residual
KNOX CO	2	39.6	41.1	-.43
LARUE CO	2	46.1	45.8	.07
LAUREL CO	2	44.8	44.7	.02
LAWRENCE CO	4	43.7	42.2	.41
LEE CO	1	40.0	39.7	.08
LESLIE CO	1	41.6	40.7	.27
LETCHER CO	2	40.4	43.2	-.77
LEWIS CO	4	40.0	41.4	-.41
LINCOLN CO	2	43.4	43.5	-.03
LIVINGSTON CO	1	43.8	44.8	-.26
LOGAN CO	2	41.3	45.3	-1.07
LUDLOW IND	5	46.3	45.3	.27
LYON CO	1	41.5	45.2	-1.00
MADISON CO	5	44.1	42.9	.33
MAGOFFIN CO	1	41.7	40.2	.42
MARION CO	2	45.2	44.7	.13
MARSHALL CO	2	43.5	46.4	-.74
MARTIN CO	1	40.8	41.4	-.17
MASON CO	4	39.9	43.4	-.97
MAYFIELD IND	2	43.2	44.8	-.43
MCCRACKEN CO	3	46.3	45.5	.21
MCCREARY CO	1	38.7	40.4	-.49
MCLEAN CO	4	44.2	43.9	.07
MEADE CO	4	46.8	45.5	.31
MENIFEE CO	1	41.7	42.7	-.27
MERCER CO	4	44.2	45.9	-.43
METCALFE CO	1	37.5	41.8	-1.25
MIDDLESBORO IND	3	38.7	44.4	-1.59
MONROE CO	2	46.5	43.7	.72
MONTGOMERY CO	4	44.0	43.3	.19
MONTICELLO IND	2	41.6	44.0	-.64
MORGAN CO	1	43.5	41.6	.51
MUHLENBERG CO	2	49.6	45.1	1.10
MURRAY IND	3	54.5	47.6	1.56
NELSON CO	4	43.8	46.0	-.57
NEWPORT IND	5	36.2	43.9	-2.24
NICHOLAS CO	4	38.0	43.7	-1.61
OHIO CO	4	41.5	42.4	-.25
OLDHAM CO	5	56.1	50.1	1.31
OWEN CO	4	42.3	44.1	-.49
OWENSBORO IND	5	46.5	44.1	.62
OWSLEY CO	1	38.3	37.8	.16
PADUCAH IND	3	46.5	43.7	.72
PAINTSVILLE IND	2	51.9	44.7	1.74
PARIS IND	5	43.1	44.2	-.30
PENDLETON CO	5	46.7	43.2	.91

DISTRICT NAME	RM INDEX	Actual 1994-96 mean	Predicted 1994-96 mean	Z-residual
PERRY CO	2	38.9	42.5	-1.02
PIKE CO	2	43.3	44.4	-.29
PIKEVILLE IND	2	54.9	45.8	2.10
PINEVILLE IND	3	47.7	42.4	1.36
POWELL CO	4	43.4	42.5	.24
PROVIDENCE IND	4	36.6	44.0	-2.14
PULASKI CO	3	43.0	45.0	-.54
RACELAND IND	5	44.5	46.9	-.61
ROBERTSON CO	1	36.3	41.7	-1.59
ROCKCASTLE CO	4	48.9	41.2	1.98
ROWAN CO	2	46.6	44.9	.44
RUSSELL CO	1	46.3	41.5	1.28
RUSSELL IND	5	48.7	48.6	.04
RUSSELLVILLE IND	2	43.4	45.7	-.60
SCIENCE HILL IND	3	55.5	47.4	1.83
SCOTT CO	5	44.5	43.9	.16
SHELBY CO	4	44.6	46.9	-.59
SILVER GROVE IND	5	53.2	46.6	1.54
SIMPSON CO	4	45.9	43.8	.55
SOMERSET IND	3	49.4	46.5	.71
SOUTHGATE IND	5	52.7	47.9	1.11
SPENCER CO	4	42.0	44.7	-.72
TAYLOR CO	2	45.7	46.7	-.24
TODD CO	4	44.9	44.2	.18
TRIGG CO	4	41.4	43.5	-.57
TRIMBLE CO	4	48.4	45.4	.74
UNION CO	4	46.7	45.6	.27
WALTON VERONA IND	5	53.7	47.7	1.37
WARREN CO	3	44.8	48.0	-.79
WASHINGTON CO	2	45.2	46.2	-.26
WAYNE CO	2	41.2	42.4	-.32
WEBSTER CO	4	44.8	44.5	.07
WEST POINT IND	4	37.0	44.4	-2.12
WHITLEY CO	2	45.4	42.2	.84
WILLIAMSBURG IND	2	58.1	44.5	3.10
WILLIAMSTOWN IND	5	43.2	44.1	-.24
WOLFE CO	1	39.4	38.3	.32
WOODFORD CO	5	46.0	47.3	-.33

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