# *DETERMINANTS OF TECHNICAL EFFICIENCY: URBAN AND RURAL PUBLIC SCHOOLS IN THE STATE OF GEORGIA*

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**ABSTRACT**

This study focuses on rural-urban public high school efficiency. School efficiency is defined as the maximum level of educational attainment obtained by given level of school inputs. In this study, school efficiency is assessed by means of data envelopment analysis (DEA) with an application to the state of Georgia using data collected on county school. Urban and rural school efficiency is evaluated by a two- step estimation process. First, a nonparametric Mann-Whitney U-test is used to determine whether the differences in mean efficiency scores between urban and rural county high schools are significant. Differences in mean efficiency scores between urban and rural county high schools are found to be significant. Second, by means of a Tobit regression analysis, factors that may contribute to this efficiency difference between rural and urban school are evaluated. The regression results confirm that rural schools operate less efficiently than urban schools. The estimated percentage of adults residing in the county school district with at least a bachelor's degree, number of people residing in the county which recognize their race as "white", and whether the school met adequate yearly progress as by the No Child Left Behind Act contribute to the differences in efficiency scores. ***JEL classifications***: I2, N3

**INTRODUCTION**

Despite the vigorous public policy interventions by Federal and State Governments over the past decades, the gap between urban and rural public school educational achievement efficiency is remarkable. Since the amount and quality of public education plays an important role in accelerating economic growth of the country, closing the efficiency differences and increasing school efficiency are important concerns to public policy decision makers in the United States.

A number of studies have investigated the quality and efficiency of the American public educational system (Rassouli-Currier (2007), Jeon and Shields (2005), Rivkin, Hanushek and Kain (2005), Saito and McIntosh (2003), Kang and Greene (2002), Goldschmidt and Wang, (1999) and Card and Kruger, (1996)). The more recent works have used a two-step approach to analyze public school efficiency. Specifically, the study by Jeon and Shields (2005) measured the relative efficiency of public school education in the Upper Peninsula of Michigan using the data envelopment analysis (DEA). Despite the fact that the Upper Peninsula is a fairly homogenous region, great variations in the efficiency of education are found. In the second stage Tobit regression, several socioeconomic factors were included to explain the efficiency variations in the region. The median family income was found to be the most important factor to improve the efficiency of education in the Upper Peninsula of Michigan. The study by Rassouli-Corrier (2007) examined the efficiency of the

Oklahoma public school districts using two different specifications. Environmental variables and non-traditional inputs were included in the second stage Tobit regression to determine the possible sources of inefficiency. The finding of the study is that the students' characteristics and family environment were the main factors affecting efficiency of Oklahoma public schools.

However, most of the existing studies examining the quality of education system and efficiency of public schools in the United States have been limited to systems in urban areas. The differential between urban and rural education systems has not been examined. "Rural schools and communities are increasingly invisible in a mass society that is fundamentally preoccupied with its urban identity, its urban problems, and its urban future" (*Why Rural Matters*, 2005).

There have been few studies that look at the efficiency of urban versus rural public schools in other countries. Mancebón and Bandrés (1999) evaluated the efficiency of 35 public-sector secondary schools in Spain by using DEA. Several outputs and inputs were used to calculate the secondary school efficiency scores. The percentage of students who passed the University Entrance Exam, the ratio between the average mark and standard deviation in the sciences, and the ratio between the average mark and standard deviation in the arts in the University Entrance Exam were included as output variables to reflect both the quality and the quantity of the academic achievements of secondary public schools. Operating expenses per pupil, number of teachers per pupil, socio-economic factors, and human capital factors were included as inputs for calculating the efficiency scores. The study found that the average efficiency of urban secondary schools was significantly higher than the efficiency of rural secondary schools.

Kantabutra and Tang (2006) examined school efficiency in Northern Thailand. They assessed the efficiency of public secondary schools by using DEA. Class size and school size were used to explain urban and rural school efficiency scores. The findings indicate that rural schools operate less efficiently than urban schools; and urban schools with larger class size appear to be more efficient than rural schools with larger class size. Finally, the study concludes that urban and rural schools with larger school size are more efficient than their smaller counterparts.

This study investigates the urban and rural public high school education efficiency. Data used in the study specifically targets county school districts throughout the state of Georgia. Georgia ranks 12$^{th}$ overall among fifty states on the basis of four rural education priority gauges: Importance, Poverty, Challenges, and Policy Outcomes (*Why Rural Matters,* 2005). The higher a state ranks, the more urgent the need for educational attention by policymakers.

The objectives of this study are twofold. First, Data Envelopment Analysis (DEA), a nonparametric technique, is used to estimate efficiency of county high schools in Georgia. DEA is a system approach that takes into account the relationship between multiple inputs and outputs simultaneously. Second, the relationship between rural-urban school efficiency measures, locations of school districts, and other relevant variables by means of a Tobit regression analysis are explored (see Rassouli-Currier (2007), Kantabutra and Tang (2006), Jeon and Shields (2005) and Saito and McInosh (2003) for other examples of this two-step approach). The understanding of the sources of efficiency at the school level is crucial for policy makers to develop appropriate educational policies to assist inefficient schools to improve their performances.

The paper proceeds with an introduction of efficiency measurement and of the development of DEA. The next section provides a description of data sources. We then present the estimation methodologies and the results. We conclude with a discussion of the main findings and their implications.

**DATA ENVELOPMENT ANALYSIS (DEA)**

Technical efficiency is the ratio of actual production to best practice (or 'frontier') production. The existence of technical inefficiencies offers an opportunity to reduce inputs without reducing outputs (input-reducing technical efficiency) or to increase output from the same amount of inputs (output-increasing technical efficiency). In the context of public schools, the output-increasing technical efficiency is more appropriate since schools should aim to obtain the maximum outcome on the basis of the available resources to them, rather than minimizing these resources (Mancebon and Bandres, 1999). The studies by Rassouli-Currier (2007), Primont and Domazlicky (2006), Kantabutra and Tang (2006), Mante and O'Brien (2002), and Mancebon and Bandres (1999) are examples that apply the output-oriented approach for assessing school technical efficiency. The DEA linear programming model is used to measure the output-oriented technical efficiency of each school district (Wossink and Denaux, 2007):

$$\text{Maximize} \quad TE_j \tag{1a}$$

$$\text{subject to} \quad TE_j y_j \le Y v_j \tag{1b}$$

$$X v_j \le x_j \tag{1c}$$

$$v_j \ge 0 \tag{1d}$$

where $TE_j$ is the measure of technical efficiency of the $j$th school district; $Y$ is a $p \times n$ matrix of $p$ outputs produced by the $n$ schools; $v_j$ is the intensity vector of the weights attached to the $n$ schools for the construction of the virtual comparison unit for schools $j$; $y_j$ is a $p \times 1$ vector of quantities of output produced by school $j$; $X$ is a $m \times n$ matrix of $m$ inputs used by the $n$ schools, and $x_j$ is the vector of these inputs for school $j$. The efficiency of the $n$ schools is assessed by solving $n$ LP models, in which the vectors $y_j$ and $x_j$ are adapted each time for the school $j$ considered.

Farrell (1957) introduced a simple method of measuring firm specific efficiency that employs the actual data of the evaluated firms to generate the frontier. So, it is assumed that the performance of the most efficient firm can be used to assess a benchmark. If a firm's actual production point lies on the frontier it is perfectly efficient. If it lies above the frontier then it is technically inefficient, with the ratio of the actual to potential production defining the level of efficiency of the individual firm. This approach yields a relative measure as it assesses the efficiency of a firm relative to all other firms in the sample.

Data Envelopment Analysis (DEA) is a linear programming based technique for measuring relative efficiency where the presence of multiple inputs and outputs makes comparisons difficult (Charnes *et al*., 1978). The basic standpoint of relative efficiency, as applied in DEA, is to individually compare a set of decision-making units (schools). DEA constructs the frontier and simultaneously calculates the distance to that frontier for the (inefficient) schools above the frontier. An output-oriented DEA uses the distance to the frontier as a measure of efficiency. The measure provides a score for each school ranging from 1 (best performance) to higher than 1 (worst performance). For example, a school efficiency score of 1.3 implies that the school in question could increase its efficiency by 0.3 or 30% (1.3-1) without changing its current input usage.

## DATA FOR EFFICIENCY ANALYSIS

The data used in this study are county-level annual data from the state of Georgia. County high schools from 153 counties in Georgia for the 2005 school year are used for the estimation.

Two measurable output variables, the high school graduation rate (Gradrt) and the average SAT score of the graduating class (Satsc), are used to gauge school district's educational achievement efficiency (output) (Kantabutra and Tang, 2006). The graduation rate is measured as the percentage of the 2005 class graduating with a regular diploma. The SAT is a standardized college admission test in the United States. Including these output variables incorporates the best performance schools that may have higher percentage of high school graduates with low SAT scores and others that may have low percentage of high school graduates with high SAT scores for a given set of inputs (Kantabutra and Tang, 2006).

Since a broad spectrum of factors contribute to schools' educational efficiency, both discretionary (under school control) and non-discretionary inputs (not under school control) are used to calculate schools' educational efficiency scores. The percentage of economically disadvantaged students enrolled (econdis) is included to capture the socioeconomic background of the student. An "economically disadvantaged" student is a student who comes from a household that meets the income eligibility guidelines for free or reduced-price meals (less than or equal to 185% of Federal Poverty Guidelines) under the National School Lunch Program (NSLP). This is a nondiscretionary variable. Students from low income families are hypothesized to achieve less academically in school. The student to teacher ratio (Str), average years of teaching experience (Exp), and unemployment rate (Urt) are included to capture the school environment. Student/teacher ratio is the number of students relative to the number of full-time equivalent professionals assigned to that school. Student-teacher ratios represent an estimate of average class size so that smaller class size is expected to improve the students' performance. The average years of teaching experience (Exp) is the sum of all the years of the faculty's professional teaching experience, in years, divided by the number of faculty members. Teacher experience is assumed to be an important factor in determining teaching effectiveness and of course, has a hypothesized direct impact on student academic performance. The unemployment rate (Urt) is the percentage of the labor force that is not employed. Urt, a nondiscretionary variable, provides important information to assess the economic environment of the region in which the school is located and needs to be taken into account when efficiency is in question.

Finally, to capture the financial makeup of the school, the sum of operating, capital and non-K-12 expenditures spent per student (Ppulexp) is included. The operating expenditures are composed of instruction, support services, administration, operations and maintenance, transportation, food services, enterprise operations, and other elementary/secondary expenditures. Capital expenditures include money spent on construction, instructional equipment, purchase of land and existing equipment, or other equipment. Non-K-12 expenditures are the monies spent to provide services to students, staff, or the community that are not related directly to, or for the support of, K-12 instructional services. Non-K-12 expenditures include payments from all funds for salaries, employee benefits, supplies, materials, and contractual services related to Non-K-12 Expenditures (www.schooldatadirect.org).

For this study, the distinction is made between urban and rural counties. A county is classified as rural on the basis that it possesses less than 150 persons per square mile. The sample size of 153 consists of 35 urban county schools and 118 rural county schools. Table 1 summarizes the descriptive statistics of the variables used in the efficiency analysis.

**TABLE 1**
**THE DESCRIPTIVE STATISTICS OF THE VARIABLES USED IN THE EFFICIENCY ANALYSIS.**

| | Urban | | | | Rural | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **Std** | **Min** | **Max** | **Mean** | **Std** | **Min** | **Max** |
| **Outputs:** | | | | | | | | |
| **Gradrt:** Percentage of the 2005 class graduating with a regular diploma | 69.28 | 8.26 | 55.20 | 91.00 | 64.87 | 9.01 | 34.00 | 87.00 |
| **Satsc:** Average SAT scores of the graduating class | 982.82 | 51.83 | 877.00 | 1078.00 | 926.31 | 64.09 | 733 | 1108.00 |
| **Inputs** | | | | | | | | |
| **Econdis:** Percentage of disadvantaged students enrolled | 45.08 | 16.20 | 11.10 | 69.10 | 60.36 | 15.73 | 16.00 | 100.00 |
| **Str:** Student to teacher ratio | 15.78 | 0.85 | 13.50 | 17.60 | 16.05 | 1.55 | 11.20 | 20.30 |
| **Exp:** Average years of teaching experience | 12.59 | 1.44 | 9.6 | 14.9 | 14.02 | 1.69 | 9.5 | 18.6 |
| **Urt:** Unemployment Rate (Urt) | 4.62 | 0.91 | 3.30 | 6.30 | 5.01 | 1.14 | 2.60 | 10.10 |
| **Ppulexp:** the sum of operating, capital, and non-K-12 expenditures spent per student | 8569.43 | 970.69 | 6942.00 | 11635.00 | 8571.42 | 1332.43 | 6060.00 | 15326.00 |
| **Observation:** | 35 | | | | 118 | | | |

**Note:** Sources of the data are: 1) Governor's Office of Student Achievement; 2) www.schoolmatters.com

## RESULTS OF EFFICIENCY ANALYSIS

The efficiency score for each school is estimated using the DEA technique solving an output-oriented linear programming model, which assumes a variable returns to scale, VRS model specification (Banker, Charnes and Cooper, 1984). The efficiency score is estimated twice in this study. First, efficiency scores were estimated by using all schools as the reference base (pooled) and then schools within the same classification as the reference base (separate). The estimation results are shown in Table 2.

**TABLE 2**
**EFFICIENCY RESULTS**

| Variables | URBAN Mean | URBAN Std. | RURAL Mean | RURAL Std. |
|---|---|---|---|---|
| All schools as reference base (pooled) | 1.07 | 0.07 | 1.12 | 0.09 |
| Same classification of schools as reference base (separate) | 1.05 | 0.06 | 1.12 | 0.09 |

Using all schools as reference base, on average, the county high schools located in rural areas have lower technical efficiency scores than those located in the urban areas. The main implication of this result is that rural county high schools could increase their educational efficiency by 12% (1.12-1.00) without consuming additional inputs; whereas urban county schools could increase their efficiency level by 7%.

The individual efficiency scores show that few county high schools are operating at or near full efficiency. Full technical efficiency, i.e. an efficiency coefficient of 1.00, implies that no other high school is more efficient in producing maximum possible output using the same level of inputs. Using the VRS specification assumption, twenty eight schools of out 153 are fully efficient. Surprisingly, of the 28 VRS –efficient schools, twenty are rural county high schools. However, a total of ten high schools (6.5%) have efficiency scores of 1.24 or higher; all are located in the rural areas.

There were interesting differences in school efficiency scores when using the same classification of schools as the reference base. Of the urban schools, 100% had efficiency scores between 1.00 and 1.19. Using the VRS specification assumption, eighteen urban high schools (51%) are fully efficient. However, of the rural high schools, only 79% had an efficiency scores between 1.00 and 1.19 and twenty rural high schools (17%) are fully efficient. Therefore, it can be concluded that rural high schools appear to be less productive than those urban schools. This finding is consistent with the study by Kantabutra and Tang (2006).

In order to determine whether the differences in mean efficiency scores between urban and rural county high schools are significant, a nonparametric Mann-Whitney U-test (two-sided) is used. It is found that the average urban high school efficiency scores differ significantly from average rural high school efficiency scores at the 1% significance level regardless of the different reference bases (test statistic of 37.5 and p-value: 0.0026 for pooled efficiency scores and test statistic of 36.62 and p-value: 0.0001 for separate efficiency score). Therefore, we can conclude that efficiency scores between urban and rural high schools are different: rural schools are producing less output than urban schools in the state of Georgia.

### Factors Affecting Efficiency of School: The Tobit-Regression

To further investigate the determinants that explain the differences in school efficiency, the individual DEA efficiency scores are used in a regression analysis to examine the relationship between efficiency and other variables available. Since the DEA efficiency scores have a lower bound of 1.00 (best practice school), this study utilizes a truncated Tobit model. For estimation purpose, following the study by Kantabutra and Tang (2006), the efficiency scores are transformed into inefficiency scores by simply subtracting 1.00 from each school efficiency scores. Then, transformed values are used as dependent variables in a Tobit model defined as:

$$y_i^* = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i \qquad u_i \sim \text{IN}(0, \sigma^2) \qquad (2)$$

where $y_i^*$ is a latent variable representing the inefficiency of school *i; xij* are independent variables *j (j=1…,k)* for school *i*; and $u_i$ is a disturbance term. Denoting *yi* as the observed dependent variable, $yi = 0$ if $y_i^* < 0$; $yi = y_i^*$ if $y_i^* \geq 0$;

The objective is to identify the common characteristics in the most efficient county schools. This relationship is critical for any effort focused on trying to increase the efficiencies of individual schools and to develop appropriate educational policies to assist inefficient schools to improve their performances.

Several non-discretionary control variables are hypothesized to affect school efficiency. The percentage of adults residing within the county school district with at least a bachelor's degree (Awba) and percentage of residents who recognize their race as "White" or "White, non-Hispanic" (Wtnhis) are included to capture community environment of the district. Both measures are related to the availability of human capital in the school district. Districts with more human capital would be expected to have higher levels of school efficiency, both as a result of better qualified workers in the schools (teachers, staff) and parents who are more able to help their children learn.

To reflect the educational policy implication on schools, a binary variable indicating if the school met "adequate yearly progress" as defined by the No Child Left Behind Act, where (1) denotes met AYP and (0) as not (Metayp) is included in the Tobit analysis as an independent variable. Finally, to capture the monetary assistant (local subsidy) to a particular school, the percentage of school local funding that comes from property taxes (Lproptx) is included. Public school teachers in Georgia are paid from the state and the local county government sources. The state pays a "base" salary and the local county government pays a supplement to this base salary which varies across the counties. Sources and descriptive statistics for the variables used in the Tobit analysis are given in Table 3.

**TABLE 3**
**THE DESCRIPTIVE STATISTICS OF THE VARIABLES USED IN THE TOBIT ANALYSIS.**

| | **Urban** | | | | **Rural** | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables[1]** | **Mean** | **Std** | **Min** | **Max** | **Mean** | **Std** | **Min** | **Max** |
| **Awab[2]:** The estimated percentage of adults residing in the county school district with at least a bachelor's degree | 26.34 | 8.49 | 14.70 | 48.7 | 15.61 | 5.16 | 8.60 | 48.60 |
| **WtnHis:** Percentage of people residing in the county who recognize their race as "white" but not "Spanish/Hispanic/Latino." | 63.90 | 17.01 | 23.60 | 94.50 | 67.93 | 16.37 | 21.90 | 97.10 |
| **Lproptx**: percentage of local funding that comes from property taxes | 69.48 | 11.38 | 42.60 | 94.20 | 68.11 | 11.40 | 39.90 | 95.60 |

**Note:** 1) The descriptive statistics of MetAyp is not reported since it is a binary variable. 2) Source of the data is: www.schoolmatters.com;

Regressions in Table 4 include the estimated Tobit coefficients and marginal effects of each factor affecting the pooled, rural, and urban high school efficiency scores (VRS specification), respectively. Table 4 indicates several noteworthy points. First, the Tobit coefficients estimates have the same sign as the marginal effects, but marginal effects are consistently less in absolute magnitude than the Tobit coefficients. Second, the calculated marginal effect is used to measure the impact of each independent variable on school efficiency score. Finally, since the transformed efficiency scores are used in the Tobit estimation as a dependent variable, the sign of each independent variable is inversely correlated with school efficiency. If the coefficient sign is negative, this suggests that there is a positive relation between independent variables and school efficiency score.

As shown in Table 4, most of the independent variables have a significant effect on calculated school efficiency scores. The first column of Table 4 provides a regression analysis on counties combined in Georgia. In order to take into consideration the “urban” or “rural” classification of high schools, a binary variable (Dummy) is included into the regression analysis to indicate whether a county is urban (Dummy=1) or rural (Dummy=0). The variables, Awaba, WtnHis, MetAyp and Dummy, are positively significant at the 1 % level. These suggest several important conclusions; an increase in the percentage of adults residing within the county school district with at least a bachelor’s degree (Awba) and percentage of residents which recognize their race as “White” or “White, non-Hispanic” (WtnHis) by 1 % would lead to an increase in public high school efficiency of 0.56 % and 0.18% respectively; the schools, which met “adequate yearly progress” (MetAyp), one of the cornerstones of the Federal No Child Left Behind Act, have higher efficiency scores; finally urban high schools are producing more output than rural schools in the state of Georgia.

The last two columns in Table 4 present the estimation results for urban and rural high school efficiency results, respectively. The signs of the marginal effects of Awab and WthHis are positive and statistically significant at the 1% significance level for efficiency measures of rural and urban high schools, with values of (-0.0058, -0.0018) and (-0.004, -0.0018), respectively. These results indicate that an increase in the estimated percentage of adults residing in the county school district with at least a bachelor’s degree (Awab) and the number of people residing in the county which recognize their race as “white” (WtnHis) by 1% would lead to an increase in the rural and urban school efficiency by (0.58%, 0.18%) and (0.4%, 0.18%), respectively.

The coefficient of MetAyp is positive and significant for rural school efficiency scores, with value of (-0.038). This result suggests that rural schools which met adequate yearly progress as governed by the No Child Left Behind Act are more technically efficient than those rural schools that don’t meet the yearly progress.

## DISCUSSION AND CONCLUSIONS

In this paper, the urban and rural school efficiency is analyzed for public high schools in the state of Georgia using data collected on county school districts. Urban and rural school efficiency is evaluated by a two-step estimation process. First, a nonparametric Mann-Whitney U-test is used to determine whether the differences in mean efficiency scores between urban and rural county high schools are significant. Differences in mean efficiency scores are found to be significant. Second, Tobit regression analysis is employed to explain the differences in the efficiency scores. The regression results confirm that rural schools operate less efficiently than urban schools. The estimated percentage of adults residing in the county school district with at least a bachelor's degree, the number of people residing in the county who recognize their race as "white" and whether the school met adequate yearly progress as by the No Child Left Behind Act contribute the differences in schools efficiency scores.

**TABLE 4**
**TOBIT REGRESSION RESULTS EXPLAINING SCHOOL INEFFICIENCY. DEPENDENT VARIABLE: DEA VRS INEFFICIENCY SCORES**

| | Pooled | | Rural | | Urban | |
|---|---|---|---|---|---|---|
| **Variables** | **CoEff.** | **MaEff.** | **CoEff.** | **MaEff.** | **CoEff.** | **MaEff.** |
| **Intercept** | 0.3654*** (0.000) | 0.3453*** | 0.3726*** (0.000) | 0.3632*** | 0.3255** (0.02) | 0.2068** |
| **Awab** | -0.006*** (0.000) | -0.0056*** | -0.006*** (0.000) | -0.0058*** | -0.007*** (0.005) | -0.004*** |
| **WtnHis** | -0.002*** (0.000) | -0.0018*** | -0.0019*** (0.000) | -0.0018*** | -0.0029*** (0.007) | -0.0018*** |
| **MetAyp** | -0.038*** (0.003) | -0.036*** | -0.039*** (0.004) | -0.038*** | -0.031 (0.359) | -0.0197 |
| **Lproptx** | 0.0004 (0.388) | 0.00037 | 0.0002 (0.6886) | 0.00019 | 0.0014** (0.02) | 0.0009** |
| **Dummy** | -0.056*** (0.003) | -0.052*** | ----------- | ----------- | ----------- | ----------- |
| σ | 0.070*** (0.004) | 0.070*** (0.004) | 0.070*** (0.004) | 0.070*** (0.004) | 0.068*** (0.011) | 0.068*** (0.011) |
| Log Likelihood | 142.89 | 142.89 | 126.10 | 126.10 | 17.70 | 17.70 |
| Number of Observations | 153 | 153 | 118 | 118 | 35 | 35 |

Note: *, **, *** represent significance at 10%, 5%, and 1% level, respectively;
*P-values* are in parenthesis, except for σ which the standard error is reported. The marginal effect for Tobit model is calculated by $\frac{\partial E(y|x)}{\partial x_j} = \beta_j \Phi(x\beta/\sigma)$) where $\Phi$ is standard cumulative density function.

The analyses presented in this paper suggest several conclusions. First, the lower efficiency of rural schools may be due to the disadvantages in students' socioeconomic and family status as well as the socioeconomic condition of the community. Supporting this idea, the student' educational achievement directly depends on the students' parent's economic condition. High-income families are believed to be more inclined to invest in their children's human capital, thus leading to a higher rate of educational achievement success. Higher educational achievement success of students would result in higher educational efficiency of schools.

The percentage of local funding that comes from property taxes is included to capture the financial makeup of the public school. The analysis indicates that the percentage of local funding from property taxes has no significant impact on school's efficiency scores. This finding could be a result of the locality's financial inability to pay salary premiums. Schools that do not have large teacher pay local subsidies may not able to attract qualified teachers and have to use part-timers. So, students may not receive adequate instructions, which lead to lower academic achievements. Therefore, local public decision-makers must recognize the importance of local salary premiums to attract qualified teachers.

Federal and State governments should allocate their funding differently to narrow the socioeconomic differences between low-income families and high-income families. So, the importance of family economic background to student's educational success would decline, making educational achievement depend on ability and effort. Finally, the urban schools that met "adequate yearly progress" have higher efficiency scores. Therefore, government should continue to focus on the effective and timely implementation of "the adequate yearly progress" program in the U.S. education system.

This study focused on the urban and rural county school efficiency for a given year. Future research will analyze the efficiency differences over time and across subgroups in the panel data setting. So, further research and better data are needed to fully explore the educational efficiency differences between urban and rural high schools.

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