# THE EFFECTS OF TEACHER MERIT PAY ON ACADEMIC ATTAINMENT: AN ANALYSIS USING DISTRICT-LEVEL DATA

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## ABSTRACT

This study uses district-level data for the academic year 2007-2008 in order to determine if teacher merit pay has any effect on student graduation rates and drop-out rates. Using data from the Schools and Staffing Survey (SASS) and the American Community Surveys, the results of this study suggest that merit pay is not positively related to student academic attainment. Factors that have an effect on academic attainment include region of residence, racial composition of student body, educational attainment of district residents, and median family income. This study is important because it is the first to use a national set of district-level data, and its findings are consistent with some of the research in this area in that it finds that merit pay has no positive and significant effects on academic attainment.

# **INTRODUCTION**

The vast majority of public school teachers in the US are compensated according to a single salary schedule. With this type of compensation system, a teacher's pay is based upon only two factors: years of experience and level of education; the quality of a teacher's instruction has no bearing on a teacher's compensation. Some believe that such a salary schedule does not promote individual achievement or excellence (Figlio and Kenny, 2007). Rather, they believe that a compensation system based more on teacher performance and less on seniority would do much to improve public education in the US. Under such a merit pay system, teachers would be monetarily rewarded if their students excel according to some measure of academic achievement. If, however, a teacher's students did not attain some minimum level of academic success, then that teacher would not receive any merit pay. If a teacher's students continually failed to meet some measure of academic success, then that teacher would slowly see their compensation decline in real terms over time. Hence, under a merit pay system, the high-performing teachers would see gains in their incomes over time while low-performing teachers would see their real incomes fall. The goal of such a system would be to give the low-performing teachers a reason to leave the profession. If these types of teachers left, then it is hoped that students would benefit from having mostly high-performing teachers in the classroom. Under the current single salary schedule system, low-performing teachers have much less of an incentive to quit the profession.

Thus, students suffer under such a system because of the greater prevalence of low-performing teachers.

The purpose of this study is to examine the effects of a merit-based compensation system for teachers on two measure of student academic attainment. The next two sections of this paper will provide further background on faculty merit pay and will discuss prior research on this topic. The empirical model will then be presented, and finally, the results will be discussed.

#### **BACKGROUND INFORMATION**

As noted in the introduction, under a merit pay system, a teacher's pay would be based on their teaching effectiveness. Low-performing teachers would receive little or no annual pay raises. Over a number of years, these teachers would see their salaries decline in real terms. Such teachers may eventually realize that their services are no longer desired and would leave the teaching profession. On the other hand, effective teachers would receive potentially substantial pay raises, which would encourage them to improve their teaching even more and would provide an incentive for others to enter the teaching profession. Given that the rewards for excellent teachers would increase under a merit pay system, it is reasonable to assume that highly qualified individuals would be more inclined to enter the teaching profession. Hence, under a merit pay system, the good teachers would be retained, the bad teachers would leave, and many potentially excellent teachers would be enticed to enter the teaching profession.

In addition to ridding the public schools of poor teachers, a merit-based compensation system would also, in all likelihood, reduce the instructional expenditures of local school districts. Instead of giving all teachers the same percentage pay increase every year, only a few teachers would receive substantial pay raises. Many others would receive much smaller raises, and some would receive no pay increases at all. Merit pay, in combination with other compensation reform measures currently being debated at the state level (elimination of collective bargaining and revamping of the state's teacher pension systems, for example) should reduce the overall cost of public education at the state and local level, thus helping to reduce the large deficits many state and local governments are currently facing.

Many teachers, however, oppose merit pay primarily because they believe that it would undermine one of the most important aspects of teaching: collaboration. Teachers would not be willing to collaborate under such a system because it would detract from their individual attainment and thus potentially reduce their compensation. In addition, if there is a fixed pool of funds for merit pay, then assisting a fellow teacher may result in less merit pay for everybody else. Of course, it may be possible to devise a merit pay plan that rewards collaboration, but whenever output is jointly produced, as education is, it is difficult to distinguish between individual levels of attainment.

There is research that supports the teachers' argument against merit pay and suggests that this type of compensation system is not a viable option in education (Murname and Cohen,

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1986). Murname and Cohen (1986) claim that many factors affect student achievement and to hold teachers directly accountable for the academic success of their students is unfair and neglects the roles that others (other teachers, parents, school administrators, and the students themselves) have in achieving scholastic success. Second, as noted earlier, collaboration is very important in teaching. Teachers must be encouraged to collaborate. However, under most merit pay plans, the role of collaboration or joint production is ignored. A successful and fair merit pay system must find a way to accurately separate individual effort from team effort and reward each accordingly. As noted earlier, it is difficult to separate out such individual achievement from team achievement in joint production efforts. Finally, the authors note that the output of the educational system is difficult to measure, especially the output that the teacher is directly responsible for producing. Unlike the production of a good, one cannot merely count the output of the educational process. Although testing has improved over the past 25 years, it is still difficult to parse out exactly the impact that a teacher has on a student versus the impact of other influences. This is especially true if this ill-defined output is produced by a team that includes both employees and non-employees of the school system.

In addition, the principal-agent theory suggests that merit pay may be particularly difficult to implement in an educational setting (Goldhaber, DeArmond, Player, and Choi, 2008). According to this theory, a principal retains an agent to perform work that profits the principal. Unfortunately, there is typically imperfect information regarding the agent's efforts on behalf of the principal. Usually, the agent knows much more about the nature of his or her work than the principal does. This theory is very relevant to the field of education: school administrators (the principals) do not know how much a teacher works, the level of their effort, or the effectiveness of their practices; measures of output (graduation rates, test scores) are imperfect at best and are affected by many other factors besides the efforts of the teachers. Thus, it may be difficult to compensate teachers based on their efforts or output, especially if the cost of acquiring such information is very high. The next section discusses some of the recent research on the topic of merit pay and student academic attainment.

#### LITERATURE REVIEW

Most of the prior empirical studies done on the effectiveness of teacher attainment pay have used only regional data or data from foreign schools (Fryer, 2011; Glewwe, Ilias, and Kremer, 2010; Glazerman and Seifullah, 2010; Goodman and Turner, 2009; Lavy, 2009, 2002; Eberts, Hollenbeck, and Stone, 2002; Ladd, 1999). An excellent review of the empirical literature and a descriptive analysis of several merit pay plans being used in various schools and districts in the US are presented in Podgursky and Springer (2007).

Only one prior study looked at the effects of teacher merit pay using data from across the U.S. (Figlio and Kenny, 2007). In this study, the authors conducted a survey of both public and private high schools in the U.S. Their survey was mostly concerned with teacher merit pay at the

school district level. Only about 40 percent of schools responded to the survey; in addition, there was a disproportionate response rate from private high schools. This survey data on merit pay was then combined with data obtained from the National Education Longitudinal Survey (NELS) and the Schools and Staffing Survey (SASS). The author's survey was conducted in 2000, the NELS data was collected in 1992, and the SASS data was collected in 1993. The authors did not believe that this eight year gap was a cause for concern. However, because the merit pay data was from 2000 and the student attainment data was from 1992, there must be some type of incongruity between these two sets of data. Nonetheless, their results suggested that those schools that have merit pay for teachers have greater student achievement, where achievement is measured as 12<sup>th</sup> grade test scores for math, reading, science, and history. However, even Figlio and Kenny (2007) admitted that they cannot determine if this relationship is causal or if better performing schools are just more likely to implement teacher merit pay programs.

Regarding other research in this area, Fryer (2011) examined the impact of teacher attainment pay on student attainment in New York City schools. A random sample of over 200 schools found that these incentives did not result in increased academic attainment as measured by grades, standardized test scores, attendance, and graduation rates. In fact, it was found that implementation of these merit-based pay standards actually reduced student achievement. Reasons given as to why merit pay didn't work include the following: incentives were too small; merit pay system was too complex; group-based awards were ineffective; and low response rate for merit pay paperwork. It was found that only 76 percent of teachers eligible for merit pay in 2009 completed the necessary paperwork to earn their bonus.

In Glewwe, Ilias, and Kremer (2010), a random sample of teachers in Kenya was used in order to determine if merit pay increases test scores and teacher attendance and reduces the student dropout rate. It was found that the incentive program increased students test scores but did not affect teacher attendance or the dropout rate. Unfortunately, the reason for these inconsistent results is because teachers focused solely on increasing students test scores, going so far as to hold test preparation sessions outside of normal school hours. In addition, given that test scores were weighted heavily in the teachers' merit pay system, teachers made little effort to lower the dropout rate or to increase their own attendance at school. Finally, there is no evidence that actual learning and greater acquisition of human capital occurred due to the existence of a merit pay system. Instead, it appears as if the teachers in Kenya ended up responding to the incentives and taught to the test.

Glazerman and Seifullah (2010) assessed the impact of the Chicago Public School's Teacher Advancement Program (TAP) on leaning outcomes. Under TAP, teachers could earn additional pay by being promoted to mentors or master teachers and could earn annual bonuses that are based on student attainment and observed classroom behavior. In its second year, TAP bonuses ranged from \$2,600 to \$6,320. The authors found no evidence that TAP increased students' test scores. In addition, teacher retention rates were not affected by the TAP program.

According to Glazerman and Seifullah (2010), these results are robust to the use of different samples and varying estimation techniques.

In Goodman and Turner (2009), a group-based merit pay system was examined for a subset of New York City schools. The purpose of this study was to determine if this type of merit pay increased student achievement. Results indicated that this group-based merit pay system had no statistically-significant effects on student achievement as measured by scores on annually administered math and reading exams.

Lavy (2009) looked at the effect of merit pay on English and math test scores in Israel. Student attainment was measured by scores on high school matriculation exams. It is important to note that the merit pay system lasted only one year and that the demographics of the student population in Israel are vastly different from that of the US. In addition, the sample selected was not random, and results from the difference-in-difference regression were biased. Nonetheless, however, Lavy found that merit pay did result in higher test scores in English and math. Lavy also found that the merit pay system enticed teachers to alter their teaching styles in order to increase test scores. Lavy, however, made no conclusions regarding the potential long term effects of this program, nor did he provide evidence that merit pay actually increased the acquisition of human capital beyond the increased test scores.

Lavy (2002) examined a merit pay system implemented in 62 schools in Israel in 1995. Results of his analysis suggested that merit pay had a significant and positive effect on student achievement, as measured by test scores and dropout rates. The results of this study were somewhat limited, however, due to the non-randomness of the sample of schools examined and the small samples sizes of some of categories of schools.

Eberts, Hollenbeck and Stone (2002) used data on two high schools in Michigan, one that utilized a merit pay system and another that used the traditional single salary schedule in order to determine if merit pay had any effect on student achievement. Employing a difference-indifference estimation technique, the authors found that merit pay did not work; in the school that implemented the merit pay system, grade point averages fell, attendance fell, and course passing rates declined in comparison to the control school.

Finally, Ladd (1999) studied the effects of a attainment pay system on student student attainment in the Dallas, Texas school system. Using state-administered standardized tests on reading and math for seventh graders as a measure of academic attainment, Ladd found that the academic attainment of White and Hispanic students increased after the implementation of the merit pay system, while the attainment of African-American students was unaffected by the program. The reasons for this difference were unknown.

In summary, the results of prior research are mixed. Merit pay appears to work in Israel and Dallas, but not in New York, Chicago or Michigan. It worked to some extent in Kenya, but even there, certain outcomes were less than desirable. Most of the prior research looked at only small subsets of schools or schools in foreign countries. In several of these studies, the authors admitted that their samples are non-random. This study expands on this body of research by using restricted-access data from the US Department of Education to determine if merit pay at the district level has any statistically-significant effect on student achievement. The next section presents the empirical model that will be used in this study.

## EMPIRICAL TECHNIQUE AND DATA

In order to examine the relationship between merit pay and student attainment, it is assumed that academic achievement is dependent upon the demographics of the student body and the resources available to the educational institutions. By incorporating all of these factors, one takes account of all of the various agents responsible for teaching a child. Hence, districts that have above average teacher salaries, low student-teacher ratios, and a well-educated populace will, on average, have higher student achievement. Ladd (1999) utilized a similar estimating model in her examination of merit pay on student attainment in Dallas, Texas.

Regarding student attainment of academic goals, two measures will be used. The first measure of academic attainment is the average freshman graduation rate. This rate is the percentage of freshmen who graduate in four years. The second measure is the total dropout rate, which is the percentage of all students in grades 9 through 12 who dropout. It is important to note that the dropout rate is not one minus the graduation rate. Students may leave the school district for reasons other than dropping out. Hence, both measures are used in order to obtain a more accurate portrayal of student academic attainment at the district level.

The following equation will be estimated in the study:

 $Y = a_0 + a_1 PAY + a_2 BONUS + a_3 STR + a_4 WHITE + a_5 BLACK$ (1) + a\_6 HISPANIC + a\_7 COLLEGE + a\_8 HIGH + a\_9 URBAN + a\_{10} RURAL + a\_{11} DAYS + a\_{12} NORTH + a\_{13} SOUTH + a\_{14} MIDWEST + a\_{15} UNEMP + a\_{16} GINI + a\_{17} INCOME + a\_{18} LUNCH.

The variables are defined as follows:

- 1. Y is a measure of student achievement. Two measures are used in the study: (a) average freshman graduation rate; (b) average drop-out rate.
- 2. PAY is the average district-level salary for public school teachers
- 3. BONUS is a dummy variables that equals one if the district rewards excellence in teaching and zero otherwise
- 4. STR is the district-level student-teacher ratio
- 5. WHITE is the percentage of the student population that is White
- 6. BLACK is the percentage of the student population that is African-American
- 7. HISPANIC is the percentage of the student population that is Hispanic
- 8. COLLEGE is the percentage of the district's population whose highest educational attainment is a bachelor's degree

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- 9. HIGH is the percentage of the district's population whose highest educational attainment is a high-school diploma
- 10. URBAN equals one of district is located in an urban area and zero otherwise
- 11. RURAL equals one if district is located in a rural area and zero otherwise; the excluded category for URBAN and RURAL is suburban, as defined in SASS.
- 12. DAYS is the length of the school year in days
- 13. NORTH equals one if the district is located in a Northeastern state and zero otherwise
- 14. SOUTH equals one if the district is located in a Southern state and zero otherwise
- 15. MIDWEST equals one if the district is located in a Midwestern state and zero otherwise
- 16. UNEMP is the district's unemployment rate
- 17. GINI is the district's Gini coefficient. The Gini coefficient is a measure of the income inequality in the district. Zero indicates total income equality; one indicates maximum inequality.
- 18. INCOME is the median family income
- 19. LUNCH is the percentage of the district's student who obtained reduced fee or free lunches.

Regarding the BONUS variable, no information is available on the amount of financial incentive involved, nor on how "excellence in teaching" is defined by each individual school district. All that is known is whether or not the district in question rewards excellence in teaching in some monetary fashion. It may very well be that one district's definition of excellence is not the same as another district's definition of excellence. Also, it is not known if merit pay takes the form of a one-time bonus or a permanent increase in the base pay of the teacher. Even though this binary variable does not shed any light on the type of financial bonus used to reward excellence in teaching, it should nonetheless be a reasonable proxy for the existence of a teacher merit pay system in a given district.

Median family income, the Gini coefficient, and percentage of students receiving free or reduced-fee lunches are included in order to capture any possible effects of family income on a student's capacity to learn. It is reasonable to assume that students whose families earn higher incomes are more likely to have parents who are college-educated, are more likely to have parents who value education, and are more likely to have opportunities, like travelling to foreign lands, that enhance the learning received in school. Hence, the greater the median family income of a district, the higher its graduation rate should be and the lower its dropout rate should be, holding all else constant.

The Gini coefficient, an index of income inequality, is included in order to capture possible public school flight. If a district has a very large amount of income inequality, it may cause upper-income families to send their children to private schools. Thus, a district may have a relatively high median family income, but if there is a large amount of income inequality, public schools may be populated with predominately lower-income children. In order to test for that possibility, the percentage of students receiving free or reduced-fee lunches is also included as an explanatory variable. This LUNCH variable is a proxy for the median-family income of students enrolled in district schools. Hence, if median district-level income is high, but if there is substantial income inequality and many students obtain free or reduced-fee lunches, then many

upper-income families may be sending their children to private schools. This may then result in lower levels of student attainment in district schools even though district-level median family income is relatively high. It is important to note, however, that this particular type of district (high median family income, high percentage of students qualifying for free or reduced fee lunches, and high Gini coefficient) is very rare; in looking at those districts with median family income above \$100,000, less than 10 percent have free lunch percentages above 43 percent, the national average.

Racial variables are included in order to determine if the racial composition of a district has any impact on graduation or dropout rates. It is expected that those districts with larger percentages of minority populations will have lower graduation rates and higher dropout rates (Ladd, 1999). Regional and urban variables are included in order to capture any possible academic attainment differences between different regions of the country and between urban and rural areas. Educational attainment variables are included in order to capture the proclivity of the district's populace to fund educational initiatives (Figlio and Kenny, 2007).

All of the education-related data were obtained from either the restricted access version of the Schools and Staffing Survey (SASS) of the U.S. Department of Education or from various publicly-available surveys that are contained in the National Center for Education Statistics; district-level demographic and socioeconomic data were obtained from the American Community Surveys. All data is district level for the academic year 2007-2008. All educational data is for public schools only. Data on approximately 1,620 (rounded to nearest 10) school districts were included in the final sample; sample size was approximately due to use of restricted data.

One potential problem with the study is its use of district level data. A disadvantage of using district-level data is that some data that is available at the state level or school level is not available at the district level. For example, data on assessment tests, such as the National Assessment of Educational Progress (NAEP), are only available for a very limited number of districts. Data on NAEP scores are readily available, however, at the state level for all states. In addition, the use of school-level data would allow for the use of much richer instruments of student achievement and teacher efforts, such as grade point averages and hours worked in the classroom. However, an advantage of using district level data is that much more readily available demographic and socioeconomic data are available at the district level than at the school level. In addition, the use of district level data.

#### RESULTS

Descriptive statistics are presented on Table 1.

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Table 1: Descriptive StatisticsN=1620 (rounded to nearest 10)				
Variable	Mean	Standard Deviation		
Graduation Rate	76.26%	13.25		
Dropout Rate	3.73%	2.94		
PAY	\$51,950	8295		
BONUS (Excellence in Teaching)	10.12%	30.18		
BONUS (Certification)	52.4%	49.9		
STR	14.74	4.11		
WHITE	64.25%	27.10		
BLACK	16.2%	20.5		
HISPANIC	14.74%	20.03		
COLLEGE	27.65%	14.1		
HIGH	59.7%	8.73		
URBAN	23.3%	42.3		
RURAL	19%	39.2		
DAYS	178	3.3		
NORTH	16.55%	37.17		
SOUTH	40.27%	49.06		
MIDWEST	23.5%	42.47		
UNEMP	4.9%	2.08		
GINI	0.427	0.044		
INCOME	\$64,857	21117		
LUNCH	40.98%	21.85		

According to these statistics, 10.1 percent of districts had a merit pay plan for teachers that rewarded excellence in teaching, the average graduate rate was 76.26 percent, the average dropout rate was 3.72 percent, the average student teacher ratio was 14.7, and 40 percent of the students received free or reduced price lunches. In comparing that percentage to the general population of students, 43 percent of all students in the U.S. received a free or reduced price lunch; hence the sample used in this study is very representative of the population, at least with regards to the percentage of students receiving free or reduced fee lunches. Finally, it is important to note that a sizeable minority of the districts are from the South (40 percent). Although graduation rates have typically been lower and dropout rates have typically been higher in the South, it is unclear if this over-sampling from the South would introduce any bias into the regression analysis. By including regional dummy variables in the regression, regional variations should be taken account of and any potential bias that this over-sampling may have introduced would have been mitigated due to the use of these regional variables.

In addition to the multivariate analysis, a simple t-test was used to compare the means of the graduation and dropout rates for those schools who had merit pay and for those schools who did not have merit pay. The test statistic for the graduation rate test was -4.41, while the test statistic for the dropout rate test was 1.48. The first test statistic suggests that the average graduation rate was statistically lower in districts that had merit pay than in districts that did not have merit pay. The latter test statistic indicates that there is no statistically-significant difference between dropout rates in districts that had merit pay and in districts that did not have merit pay. These results may suggest that either merit pay doesn't work or that high performing districts did not feel a need to implement it.

In order to test this theory, data was obtained on merit pay plans for the year 2004. There were approximately 80 districts that did not have a merit pay system in 2004 but had implemented one by 2007. It was found that there was no statistically significant difference between the average graduation and dropout rates in 2004 and the average graduation and dropout rates in 2007 for this group of districts. The test statistic for the graduation rate was 1.044, and the test statistic for the dropout rate was -0.975. Although not conclusive evidence, these results suggest that merit pay may not be effective in increasing district-level student achievement.

Ordinary least squares (OLS) was used to estimate equation (1). Regression results are presented on Tables 2 and 3. These results suggest that merit pay is not significantly related to either of the measures of student attainment that were examined. This finding is significant since the results of recent research on this topic have been mixed. Some prior studies have found that merit pay plans had significant effects on student attainment (Lavy, 2009, 2002; Glewwe, Ilias, and Kremer, 2010; Figlio and Kenny, 2007; Ladd, 1999). Many other studies, however, found that merit or attainment pay plans had no effects on student achievement (Fryer, 2011; Glazerman and Seifullah, 2010; Goodman and Turner, 2009; Ebberts, Hollenbeck, and Stone, 2002).

Regarding the significance of other variables, districts that had larger percentages of African-American students had lower graduation rates; for every one percentage point that the share of African-American students increased by, the graduation rate dropped by 0.26 points. Districts with larger percentages of African-American students had higher dropout rates. Districts with larger percentages of residents with a college degree had higher graduation rates and lower dropout rates; for every one percentage point that the share of college-educated adults increased by, the graduation rate increased by 0.54 points, and the dropout rate fell by 0.077 points. Districts with higher unemployment rates had lower graduation rates; for every point increase, the graduation rate fell by 0.23. Higher percentages of students receiving free or reduced fee lunches resulted in lower graduation rates; for every point increase, the graduation rate fell by 0.041 points. Districts with lower incomes had lower graduation rates and higher dropout rates; for every \$1000 decrease in median family income, the graduation rate fell by 0.092 points, and the dropout rate increased by 0.022 points. These results are reasonable and

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 Table 2: OLS Regression Results
**Dependent Variable: Graduation Rate** Variable Coefficient Standard Error Test Statistic Constant 26.49 14.45 1.833\* PAY 0.000027 0.000036 0.767 BONUS (Excellence in Teaching) -0.829 0.707 -1.173 STR 0.039 0.677 0.0578 WHITE -0.0318 0.0331 -0.962 -7.511\*\*\* BLACK -0.2597 0.0346 HISPANIC -0.04711 0.0351 -1.344 10.327\*\*\* COLLEGE 0.5418 0.0524 6.49\*\*\* HIGH 0.3568 0.0549 URBAN 0.593 -2.668\*\*\* -1.582 4.462\*\*\* RURAL 2.855 0.639 DAYS 0.0943 0.069 1.367 5.544\*\*\* NORTH 4.95 0.89 7.575\*\*\* SOUTH 5.77 0.761 9.637\*\*\* MIDWEST 7.27 0.754 UNEMP -0.2344 0.1371  $-1.710^{*}$ -2.215\*\*\* GINI -15.33 6.922 0.000092 3.665\*\*\* INCOME 0.000025 0.01745 -2.355\*\* LUNCH -0.0411 Notes: Adjusted  $R^2 = 0.604$ F = 138.4310% Level of Significance = \* 5% Level of Significance = \*\* 1% Level of Significance = \*\*\*

suggest that many factors not under the control of the teachers or school administrators have rather large effects on student achievement (Figlio and Kenny, 2007; Ladd, 1999).

In order to test the robustness of the above results, another type of merit pay was examined. One of the variables included in the SASS data set was a dummy variable that equaled one if merit pay was awarded to a teacher who became certified through the National Board for Professional Teaching Standards (NBPTS) and zero otherwise. This certification is an advanced teaching credential that teachers obtain after undergoing a thorough assessment of their teaching abilities. In the sample used in this study, 52 percent of districts gave some type of merit pay to teachers for obtaining NBPTS certification. Once again, it is important to note that

it is not known in what form the merit pay was awarded. However, unlike the "excellence in teaching" criteria for awarding merit pay, there is much less subjectivity with this criteria. In all districts that awarded this type of merit pay, if a teacher had earned NBPTS certification, then they would be eligible for the merit pay. In order to see if this type of merit pay resulted in an increase in student academic attainment, equation (1) was re-estimated, replacing the "excellence in teaching" merit pay dummy variable with an NBPTS merit pay variable. The NBPTS variable equaled one if the district awarded merit pay to teachers who had earned the NBPTS certification and zero otherwise. Results are presented on Tables 4 and 5.

Table 3: OLS Regression Results						
Dependent Variable: Dropout Rate						
Variable	Coefficient	Standard Error	Test Statistic			
Constant	25.744	4.32	5.946***			
PAY	-0.0000046	0.000011	-0.431			
BONUS (Excellence in Teaching)	0.203	0.212	0.962			
STR	-0.0361	0.0173	-2.083**			
WHITE	-0.01268	0.0099	-1.28			
BLACK	0.02162	0.01035	2.087**			
HISPANIC	-0.0122	0.0105	-1.159			
COLLEGE	-0.07754	0.0157	-4.933***			
HIGH	-0.05313	0.01647	-3.226***			
URBAN	0.456	0.177	2.569**			
RURAL	-0.383	0.192	-1.998**			
DAYS	-0.0822	0.0206	-3.979***			
NORTH	-1.039	0.267	-3.884***			
SOUTH	-1.803	0.228	-7.907***			
MIDWEST	-1.62	0.226	-7.209***			
UNEMP	0.0323	0.04106	0.787			
GINI	4.358	2.074	2.101**			
INCOME	-0.000022	0.0000076	-2.938***			
LUNCH	0.00173	0.00522	0.331			
Notes: Adjusted $R^2 = 0.282$ F = 36.41 10% Level of Significance = * 5% Level of Significance = ** 1% Level of Significance = ***						

Results suggest that merit pay based on national teacher certification is significantly and negatively related to graduation rates and positively related to dropout rates. These results suggest that certification in and of itself may not increase student academic attainment. Another possible explanation for this finding is that high performing districts may not feel the need to reward teachers that obtain NBPTS certification. Hence, only low performing districts may offer this type incentive, thus creating the perverse result we see here.

Table 4: OLS Regression ResultsDependent Variable: Graduation Rate					
Variable	Coefficient	Standard Error	Test Statistic		
Constant	25.82	14.36	1.798*		
PAY	0.000031	0.000036	0.878		
BONUS (Certification)	-1.96	0.447	-4.376***		
STR	0.018	0.0575	0.314		
WHITE	-0.0323	0.0328	-0.985		
BLACK	-0.2544	0.0344	-7.397***		
HISPANIC	-0.0546	0.0348	-1.568		
COLLEGE	0.5428	0.0521	10.408***		
HIGH	0.3513	0.0547	6.425***		
URBAN	-1.587	0.589	-2.693***		
RURAL	2.78	0.636	4.369***		
DAYS	0.109	0.0687	1.59		
NORTH	4.07	0.912	4.461***		
SOUTH	5.552	0.752	7.38***		
MIDWEST	6.665	0.762	8.746***		
UNEMP	-0.2886	0.1368	-2.11**		
GINI	-14.25	6.88	-2.068**		
INCOME	0.000088	0.000025	3.498***		
LUNCH	-0.0433	0.01737	-2.494**		
Notes: Adjusted R <sup>2</sup> = 0.609 F = 140.95 10% Level of Significance = * 5% Level of Significance = ** 1% Level of Significance = ***					

In fact, if we look at a simple t-test comparing the average graduation rate of those districts that reward certification and those that do not, we obtain a test statistic of -8.865. This result indicates that districts that reward certification have statistically lower graduation rates

than those districts that do not reward certification. For the dropout rate, the test statistic is 3.89, which indicates that districts that reward certification have higher dropout rates than those districts that do not reward certification. These results corroborate the results of the regression analysis.

Most of the other explanatory variables in the certification regressions were significant with the same signs as were found in the "excellence in teaching" regressions. These additional regressions illustrate the robustness of the results of this study in that merit pay, regardless of the criteria used to award it, does not improve academic attainment.

Table 5: OLS Regression ResultsDependent Variable: Dropout Rate					
Variable	Coefficient	Standard Error	Test Statistic		
Constant	25.76	4.32	5.963***		
PAY	-0.0000054	0.000011	-0.499		
BONUS (Certification)	0.289	0.135	2.148**		
STR	-0.0325	0.0173	-1.88*		
WHITE	-0.0124	0.00989	-1.261		
BLACK	0.0209	0.01035	2.029**		
HISPANIC	-0.01078	0.01047	-1.03		
COLLEGE	-0.0775	0.0157	-4.938***		
HIGH	-0.0522	0.01645	-3.174***		
URBAN	0.459	0.177	2.594***		
RURAL	-0.373	0.192	-1.948*		
DAYS	-0.0842	0.0206	-4.074***		
NORTH	-0.91	0.274	-3.317***		
SOUTH	-1.762	0.226	-7.781***		
MIDWEST	-1.538	0.229	-6.708***		
UNEMP	0.04056	0.0411	0.985		
GINI	4.22	2.073	2.036**		
INCOME	-0.000021	0.0000076	-2.841***		
LUNCH	0.00202	0.00522	0.387		
Notes: Adjusted $R^2 = 0.284$ F = 36.70 10% Level of Significance = 5% Level of Significance = * 1% Level of Significance = *	* * **				

#### CONCLUSION

Using district-level data, the results of this study suggest that there is no statisticallysignificant and positive relationship between teacher merit pay and student academic attainment as measured by graduation and dropout rates; for certification bonuses, results suggest that such merit pay may even be related to lower student achievement. As noted earlier, one possible explanation for these results may be the principal-agent theory (Goldhaber, DeArmond, Player, and Choi, 2008). Given that there is imperfect information regarding the agent's efforts on behalf of the principal, it may be difficult to compensate teachers based on their efforts or output, especially in the education field due to the high cost of acquiring such information. Thus, given the difficulty in evaluating the direct impact that individual teachers have on student academic attainment and the logistical problems involved with rewarding effective practices and behavior appropriately, it is not surprising to find that there is no positive and significant relationship between merit pay and student academic attainment. Finally, this study is an important contribution to the body of research in this area because it is the first study to use a national set of district-level data, and its findings are consistent with some of the research in this area in that it finds that merit pay has no positive and significant effects on student academic attainment.

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