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Pennsylvania Teachers' Strikes and Academic Performance

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Summary

Critics of Pennsylvania teacher strikes have claimed that strikes have an adverse impact on student achievement. However, they have produced no evidence to support this claim. In response to continued public discussion of the impact of teacher strikes, Dr. Harris Zwerling (Assistant Director of Research - PSEA) conducted a study of the potential academic effects of strikes, using Pennsylvania System of School Assessment (PSSA) test scores from 2003-04 to 2006-07 and several different statistical models.

Dr. Zwerling was unable to find any statistical relationship between the incidence of teacher strikes and their duration and district level student performance on 46 different PSSA tests. His study supports prior research in finding that Pennsylvania teacher strikes are not associated with negative academic outcomes, measured by district level PSSA test performance, attendance and graduation rates.

Since the passage of Act 88 in 1992 through 2006-07, 21.1 percent of Pennsylvania's 603 School Districts, IUs, and Vocational Technical Schools have experienced teachers' strikes. Only 3.6 percent have had more than one strike in that 15-year span. Seventy-seven percent (384) of Pennsylvania's 500 operating school districts have not experienced a teachers' strike during this 15-year span.

From 1970 to 1992, there was an average of 27.6 teachers' strikes annually. Since the passage of Act 88 (through 2006-07), there has been an average of 8.6 teachers' strikes per year. The average duration of teachers' strikes has not subsequently returned to the levels reached during the 1970s and 1980s. From 1970 to 1992, the average duration of teachers' strikes was 15.4 days. Since then it has dropped to 12 days.

During the last two school years, the number of teacher strikes increased to 13 each year. Prior to that, the number of strikes had reached double digits (10) only once in the last decade (2002-03).

Dr. Zwerling examined PSSA scores, graduation rates and attendance data of school districts which have experienced teacher strikes between 1992-93 and 2006-07 and compared those districts to school districts which had not experienced strikes during the same period. He concluded, "This study supports prior research in finding that Pennsylvania teacher's strikes are not associated with negative academic outcomes, measured here by district level PSSA test performance, attendance and graduation rates."

There are two other reasons one might expect that Pennsylvania teachers' strikes would have no relationship to PSSA performance. First, the 12-day average duration of teachers' strikes between 1992-93 and 2006-07 is little longer than the typical Christmas recess. Second, Pennsylvania's Act 88 of 1992 requires that days lost to work stoppages must be made up so that schools must provide a minimum of 180 days of instruction.

Strikes are difficult and unpleasant experiences, and will continue to be a last resort for our members when negotiations fail to reach a settlement. But Dr. Zwerling's research does debunk the claim that strikes have a negative impact on academic performance.

Pennsylvania Teachers' Strikes and Academic Performance

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Abstract

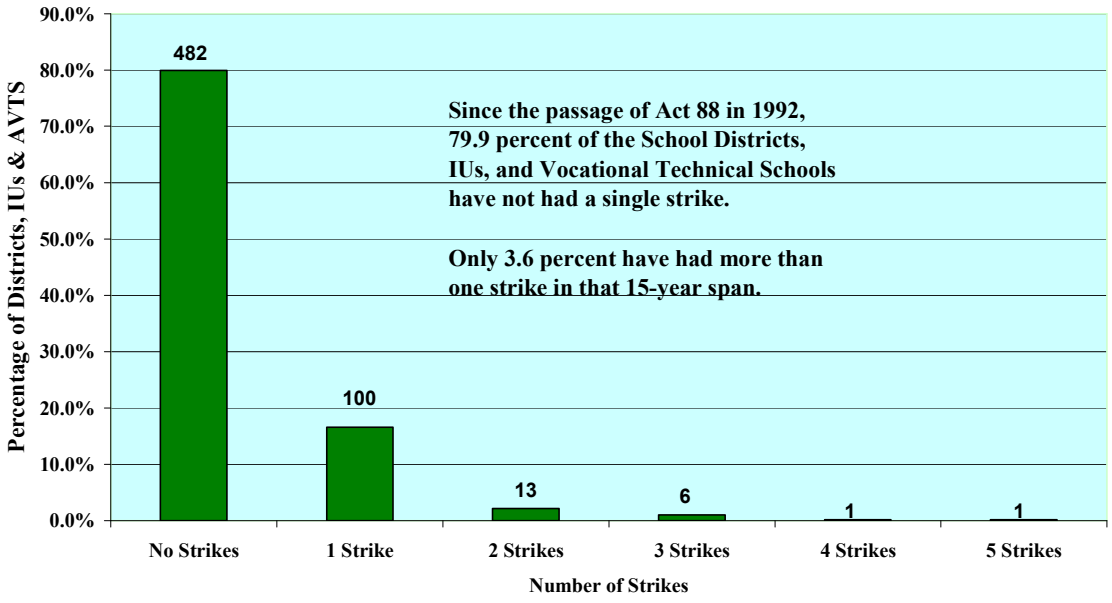
Recent increases in the level of Pennsylvania teacher strike activity have led to renewed attention to the effects these labor disputes have had on students and their communities. While strikes have undoubtedly disrupted the child care function of school districts, there have been few empirical studies of the potential academic effects of strikes.

Critics of Pennsylvania teacher strikes have claimed that strikes have an adverse impact on student achievement. However, they have produced no evidence to back up this allegation (Gamrat and Haulk, 2006; Weaver, 2007: 11). Using Pennsylvania System of School Assessment (PSSA) test scores from 2003-04 to 2006-07 and several different statistical models, the author was unable to find any statistical relationship between the incidence of teacher strikes or their duration and district level student performance on 46 different PSSA tests. Another part of this project found a weak positive association between the incidence of teachers' strikes or their duration and both district level graduation and attendance rates (i.e., districts that experienced strikes have higher graduation and attendance rates) for the school years 2002-03 through 2006-07. The author considers this result to be a statistical anomaly seeing no other plausible explanation.

Background

Since the passage of Act 88 in 1992 through 2006-07, 21.1 percent of Pennsylvania's 603 School Districts, IUs, and Vocational Technical Schools have experienced teachers' strikes. Only 3.6 percent have had more than one strike in that 15-year span (see Figure 1). Seventy-seven percent (384) of Pennsylvania's 500 operating school districts have not experienced a teachers' strike during this 15-year span.

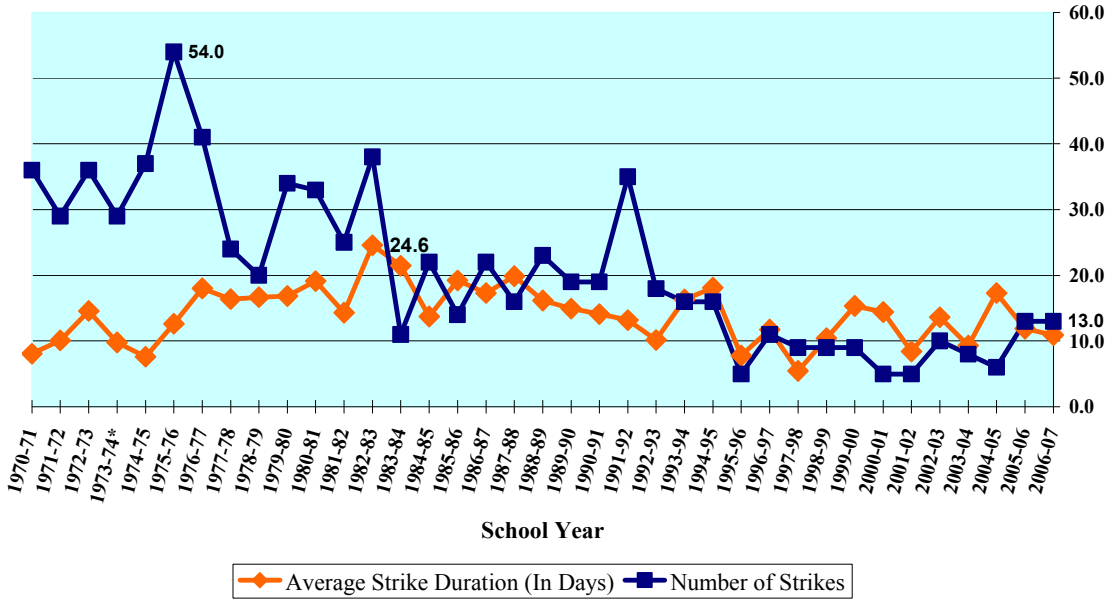
Figure 1
Pennsylvania Teachers' Strikes
From 1992-1993 to 2006-2007



From 1970 to 1992, there was an average of 27.6 teachers' strikes annually. Since the passage of Act 88 (through 2006-07), there has been an average of 8.6 teachers' strikes per year. Figure 2 illustrates the dramatic decrease in the annual incidence of teachers' strikes after the passage of that legislation. The average duration of teachers' strikes has not subsequently returned to the levels reached during the 1970s and 1980s. From 1970 to 1992, the average duration of teachers' strikes was 15.4 days. Since then it has dropped to 12 days.

During the last two school years, the number of teacher strikes increased to 13 each year. Prior to that, the number of strikes had reached double digits (10) only once in the last decade (2002-03). This may in part be responsible for the renewed concern over the impact of Pennsylvania teachers' strikes and have given some impetus to calls for new legislative restrictions. The rest of this paper will examine the evidence of the academic correlates of teachers' strikes.

Figure 2
Number of Pennsylvania Teacher Strikes and Average Duration
1970-71 through 2006-2007



Previous Research

In 1992, Lehigh University Professor Perry Zirkel published a comprehensive review of the empirical literature regarding the effects of teachers' strikes. Although he found a few studies that suggested a negative impact of teachers' strikes, he concluded that "contrary to the common conception, teacher strikes do not have a marked effect on the attitudes, attendance, and achievement of public school students (123)."

In 1994, Professor Kenneth Thornicroft, then of the University of British Columbia, published a study of the impact of teacher strikes on Ohio public school students using data from 1984-1990. He concluded: "The foregoing results suggest that strikes, at least in Ohio over the period in question, did not have any meaningful impact on student achievement as measured by standardized test scores (36)."

Despite the lack of evidence indicating teachers' strikes produce lasting negative academic consequences, some policymakers and think tank analysts continue to cite these putative effects as part of their rationale for restricting or eliminating the right to strike. Recent proposals for replacing Pennsylvania's limited right to strike with binding interest arbitration or some other form of disputes resolution suggest that it would be appropriate to look at new evidence of the academic effects of teachers' strikes in Pennsylvania. The availability of more detailed data on student achievement and school demographics also makes this new look worthwhile.

Estimating Models and Data Set

Ideally, one would want to use either a controlled experiment or at least a matched sample of strike and non-strike districts to estimate a causal relationship between the incidence of teachers' strikes and academic outcome measures (Stuart, 2007). The former is not feasible for the obvious reason that teachers' strikes are not a treatment subject to experimental manipulation. The latter is also considered infeasible due to the relatively small number of districts that experienced strikes and the much smaller proportion that did in any given year. Thus, the design employed in this study will follow the extensive education production function literature to estimate the relationship between teachers' strikes and educational outcomes (Carini, 2002; Finn, 2002; Zwerling and Thomason, 1994). Put simply, educational outcomes are estimated as a function of student background characteristics, their family inputs, peer influences, and school inputs. Following Thornicroft (1994, 34), one could simply characterize these models as consisting of "strike" and control variables.

Dependent Measures

The data used for this analysis came from various sources. Pennsylvania System of School Assessment (PSSA) mathematics and reading tests were administered to students in the state's 500 operating school districts for grades 5, 8, and 11 during the school years 2003-04 and 2004-05[1]. Tests for grades 3, 4, 6, and 7 were added in 2005-06. Results for the 2006-07 PSSA tests are also included[2]. Over these years, a total of 46 math and reading tests were administered. All PSSA results are publicly available from the Pennsylvania Department of Education's (PDE) website. For the achievement analyses, the dependent measure was the percentage of students scoring advanced and proficient on the math and reading tests (Tables 1a, 1b, & 1c)[3]. This measure was chosen because under "No Child Left Behind" Act (NCLB) of 2001, scoring proficient or better is considered "passing" and is used as the basis for calculating Adequate Yearly Progress (AYP), which in turn, is central to NCLB's accountability scheme[4]. Given the possibility that strikes might affect students differently depending on their grade level and subject area, this study examined each PSSA test separately, rather than combining them into an overall district level performance index.

In order to address the possibility that strike and non-strike districts differed in academic performance prior to the period of the measured labor dispute due to some unobserved factor, two strategies were employed. The first was to use a lagged dependent measure as a predictor (the percentage of students scoring advanced and proficient on the math and reading tests at the same grade level in 2001) in the equations for the different cohorts (Tables 2a & 2b). A second approach changed the dependent measure in order to account for initial status. In these equations (Tables 3a & 3b), the dependent measure was the change in test scores for the same grade level from 2005-06 to 2006-07. This measured the relationship between teachers' strikes and district-level aggregated performance change[5].

Two other important academic outcomes were entered as dependent measures, attendance and graduation rates (for the years 2002-03 to 2005-06). They also were obtained from the PDE website[6].

Control Variables

Under the reporting requirements of the NCLB, states must break down test performance by a number of demographic categories that capture educationally important student, peer, and family characteristics. This has provided an extensive set of demographic background controls which the education literature has shown to relate strongly to student performance. Some of these measures were previously unavailable to researchers looking at the correlates of teachers' strikes. The PDE data set allows calculation of the proportion of test takers who are economically disadvantaged thus qualifying for Free and Reduced Price Lunches (***% Economically Disad***), the proportion of test takers who are Black or Hispanic (***% Black & Hispanic***), and the proportion of test takers who had individualized educational plans (IEPs) (***% IEP***). The overwhelmingly majority of students with IEPs have some form of learning disability. In 2005-06, 3.9 percent of Pennsylvania's public school students were academically gifted compared with 14.8 percent who were disabled (Pennsylvania Department of Education, 2007). While these categories overlap, it is safe to conclude the bulk of students with IEPs are not gifted. In the achievement equations, attendance and graduation rates were included as additional measures of peer effects. Similarly, for the attendance and graduation rate models, the percentage of students scoring proficient or advanced on the PSSA 11th grade reading test in the same year was included as a control variable.

School inputs are measured using district level measures of teachers' characteristics, a measure of district size, and one of district expenditures on education. The data for the following teacher-related measures are provided by the school districts to the PDE. Average bargaining unit salary (***Average BU Salary***) is a measure that includes full-time teachers, and a much smaller number of librarians, guidance counselors, and nurses, as well as department chairpersons who spent at least half of their time in the classroom. This measure is calculated by PSEA from the PDE data. Average Total Service (***Average YRS Service***, ***Average YRS Service SQ***) is the total of all credited years of service in any school district, divided by the number of full-time bargaining unit members. This variable was entered in the estimating equations in both linear and quadratic form to capture non-linear effects of the teachers' experience. The percent of teachers within a district that had an earned Master's Degree (not a Master's Equivalency) or a higher degree (***Masters***) is a restricted measure of their educational attainment. These teacher-related measures were only available up to 2005-06 at the time of the analysis.

District size was measured by the Average Daily Membership (***ADM***). That is computed by taking the sum of all daily memberships and dividing by the number of instructional days. This variable was entered in the estimating equations in both linear and quadratic (***ADMSQ***) forms to capture possible non-linear effects of school size (Wainer and Zwerling, 2006). (ADMs are used to calculate the basis for the weighted average daily membership (WADM) calculation.) District educational spending was measured with

Actual Instruction Expense per WADM (***AIE/WDM***). That is computed by dividing a district's actual instruction expense by its number of reimbursable pupils. The Actual Instructional Expenses is an official state measure, calculated by the PDE. These district level school inputs were available up to 2006-2007.

Focal Variables

Defining the strike variable involves a number of choices. As noted above, approximately twenty-three percent (116) of Pennsylvania's operating school districts experienced at least 1 teachers' strike since 1992-1993. Twenty districts had more than one strike. The effects of strikes are likely to attenuate over time, so strikes were measured by a dummy variable (***2-YR Strike Dummy***) indicating if there had been one strike (or more) in the test year or preceding year (strike = 1, no strike = 0). Previous researchers have looked for longer term strike effects. So alternatively, strikes were measured by dummy variables that indicated whether a district experienced a teachers' strike during at least one year the tested grade cohort attended school in that district (***Multiyear Strike Dummy***). For example, for fifth grade PSSA test takers, the strike dummy was coded to equal 1 if there had been a strike any of the five years that cohort was in grades 1 through 5 and coded 0 if there had been no strike. Strike data was compiled by the Pennsylvania State Education Association.

Previous research has also examined the possibility the length of a strike is related to academic outcomes. For that reason the total strike duration (***Duration***) for the test year and preceding year was entered into the equations in place of the strike dummy. The strike duration results are reported in the "b" tables.

The strike dummy and duration variables were interacted with the three key demographic controls: the percent of test takers who are economically disadvantaged (***% Economically Disad***), Black and Hispanic (***% Black & Hispanic***), and who had individualized educational plans (***% IEP***). Given public policy's mandate placed upon schools to reduce "achievement gaps" for these groups, it is important to test if teachers' strikes appear to be associated with greater academic risk for these subgroups.

Graduation and attendance rates represent different sorts of outcome measures than test performance. Since there is little reason to believe that students' decisions to drop out or their daily decisions to attend school could be influenced in the long run by the occurrence of a teachers' strike, the graduation and attendance rate models only included the 2-year strike dummy (as well as the 2-year duration measure).

Results

PSSA Performance

Several different specifications of the models described above were tested. The results for the final models are summarized in Tables 1 through 3 appearing in the Appendix at the end this paper. (The complete output is available from the author upon request.) In order to increase the probability of detecting a strike effect this study selects significance levels of .1 as being statistically significant, although the .05 is more generally considered conventional (Schneider, Carnoy, Kilpatrick, Schmidt, and Shavelson, 2007: 27). Thus, this increases the likelihood of finding a "strike effect" on student performance. In Tables 1 through 3, the parentheses contain the number of coefficients that attained significance only at the .1 level. (The absence of parentheses indicates none of the coefficients were significant at the .1 level.) The other numbers preceding a "+" or "-" indicate the total number of coefficients attaining significance at all levels (.1, .05, or .01 or greater) and after the slash, the total number of regressions. At the bottom of each table is the average adjusted R^2 for all the regressions summarized by the table.

Focal Variables

Tables 1a, b, and c present the results for the regression of the percentages scoring advanced or proficient on the independent variables. They differ only by the strike measures and their interactions. The "a" model includes 2-year strike dummy variables, the "b" model employs 2-year continuous strike duration variables, and the "c" model uses multiyear strike dummy variables. The average adjusted R^2 reported at the bottom of each table indicates negligible differences in the explanatory power of each model. The "c" model was weakest empirically and the least plausible theoretically, so it was dropped from subsequent analyses.

Results across Tables 1 a, b, and c suggest no systematic relationship between the incidence of strikes or their duration and PSSA performance. In the first model (Table 1a) seven of the 46 regressions show a statistically significant positive sign on the strike dummy variable, while 2 of the 46 regressions show a statistically significant negative relationship. The proportion of significant positive coefficients (15.2%) only weakly exceeds what might occur by chance at the .1 significance level. Moreover, there is no theoretical reason to believe teachers' strikes would have a positive relationship to test scores once other school inputs are held constant. The attenuated results for tables 1b and c, particularly the multiyear strike dummy (Table 1c), tend to support the view that the positive relationship in the first regression is an anomaly.

The strike/duration demographic variable interactions produced equivocal evidence that strikes might adversely impact Black and Hispanic students (Table 1b). Six of those 46 interactions produced statistically significant negative relationships between the strike/economic disadvantage interaction term and PSSA performance. One interaction

produced a positive and statistically significant relationship[7]. However, this result weakened somewhat as seen in Table 1c. The other strike/demographic interactions (with the percentage of test takers who were economically disadvantaged and the percentage with IEPs) only produced 3 statistically significant results apiece. In both cases 2 of the 3 signs were positive.

Tables 2a and b differ from Tables 1a and b only in that these report models that include a lagged value of the dependent variable (the percentages scoring advanced or proficient on the PSSA tests) as a predictor. As expected with a lagged value of the dependent variable included among the predictors, the average explained variance is substantially higher than for the models reported in Tables 1a, b, and c. Since the average adjusted R^2 for Tables 2a and b are the same, there is no reason to prefer the strike dummy or duration regressions.

Here we see no association between the strike variables and PSSA performance levels now that prior performance is held constant. The negative interactions between the strike variables and the percentages of Black and Hispanic students, remain in 4 of the 30 regressions (13%), or barely beyond what might be expected by chance. Thus, this possible relationship may merit closer examination with more refined data sets and analytical techniques.

Tables 3a and b differ from Tables 1a and b in the dependent measures. These models reported in these tables use the change in the proportion scoring advanced and proficient on each test between the years 2005-06 and 2006-07. While these dependent measures do control for initial status, they are not true growth measures since the 2 years of data measure different student cohorts. As indicated by the average adjusted R^2s, these models have negligible explanatory power. The duration variable shows a very weak (barely above chance, 14%) negative relationship to test score changes. All of the strike duration interactions show no evidence of a strike impact.

Control Variables

The overall lack of statistically significant relationships between the strike dummy/ duration variables or their interactions with key demographic variables on the one hand and PSSA performance on the other, stands in stark contrast to the results for the other control variables. In models reported in all of the Tables 1 and 2, the three student demographic controls (***% Economically Disad***, ***% Black & Hispanic***, ***% IEP***) had the strongest relationship to PSSA performance. Not surprisingly, the relationships were all negative. Graduation and attendance rates also bore a very strong relationship to the test scores, although in this case the relationships were positive. The results for the demographic variables remained strong even with the introduction of the lagged test score as a control variable (Tables 2a and b). Given the different nature of the dependent measure and general loss of explanatory power for the models reported in Tables 3a and b, it is not surprising to see a much weaker, different pattern of results among the demographic controls. However, even in these models, the demographic produced the strongest relationships to the outcome (test change) measure.

School input variables produced an interesting pattern of results. Average bargaining unit salaries were moderately and positively related to test performance in Tables 1a, b, and c. This relationship all but disappeared in the models reported in the second set of tables. However, the proportion of teachers' with at least a master's degree behaved similarly, but held up even when the lagged test score was entered into the model.

Finally, the first two sets of tables show a moderate curvilinear relationship between district size (***ADM***, ***ADMSQ***) and performance levels. Performance increases along with size and then declines with the largest districts. The first set of tables shows a moderate positive relationship between actual instructional expenditures per student and performance levels. This relationship nearly disappears when the lagged test score is included in the second set of models.

Graduation and Attendance Rates

Looking at other important academic indicators, this study included two regression models estimating the association between teacher strikes and 1) district level graduation rates and 2) attendance rates for the school years 2002-03 through 2006-07. The strike variable (Table 4a) measured whether a strike occurred either in the year of or prior to the year of the measured attendance and graduation rates. The duration variable measured the cumulative duration of strikes that occurred in the same years (Table 4b).

In none of the four years was there a statistically significant negative relationship between the strike dummy or duration variables and attendance or graduation rates.

In fact, all eight strike dummy and duration variables bore a ***positive*** and statistically significant relationship to graduation and attendance rates. The author considers this result to be a statistical anomaly seeing no other plausible explanation.

The strike/duration demographic interactions also do not support the conclusion that there is a negative relationship between the occurrence of teacher strikes and either attendance or graduation rates. It is worth noting that among the other covariates, PSSA performance consistently bore a strong, statistically significant relationship to both graduation and attendance rates, while the socio-demographic measures (***% Economically Disad***, ***% Black & Hispanic***) consistently had a strong, statistically significant negative relationship to the outcome measures. The expenditure (***AIE/WDM***) and district size (***ADM***, ***ADMSQ***) variables bore a strong positive relationship to graduation rates.

Discussion

Clearly, socioeconomic, demographic, and peer background variables produced the strongest association with test scores, graduation and attendance rates. This is consistent with a vast body of educational literature dating to the Coleman Report (Gamoran and Long, 2006).

This study offers little evidence to suggest teachers' strikes are negatively related to academic outcomes. The models reported in Tables 1a, b, and c, show moderate relationships between district inputs (such as teachers' salaries, their educational attainment, or actual instructional expenditures) and academic performance. The main strike or duration effects in these tables suggest no relationship to performance, while the interactions indicate there was weak evidence in 6 of 46 regressions that teachers' strikes might negatively relate to the performance of districts with greater proportions of Black and Hispanic students. Unreported Beta coefficients indicate that teacher salaries had a substantially greater relationship to PSSA performance than the negative strike/duration interactions with ***% Black & Hispanic***. This result suggests that policymakers who might be concerned by the very weak evidence of a negative academic impact of teachers' strikes on minority students should pause before eliminating the right to strike. The evidence that teachers' salaries are positively related to test performance (even holding overall instructional expenditure constant) raises the concern that any alternative disputes resolution procedure may result in lower average teacher salaries (see also, Freeman and Valetta, 1988) with a net effect of reducing academic performance.

Conclusion

Generally, this study supports prior research in finding that Pennsylvania teacher's strikes are not associated with negative academic outcomes, measured here by district level PSSA test performance, attendance and graduation rates. There are two other reasons one might expect that Pennsylvania teachers' strikes would have no relationship to PSSA performance. First, the 12-day average duration of teachers' strikes between 1992-93 and 2006-07 is little longer than the typical Christmas recess. Second, Pennsylvania's Act 88 of 1992 requires that days lost to work stoppages must be made up so that schools must provide a minimum of 180 days of instruction.

Appendix

Table 1a:		
Dep Var: PSSA % ADV & PROF (46 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
2-YR Strike Dummy	(3) 7/46+	(2) 3/46-
Average BU Salary	(6) 23/46+	0/46-
Masters	(7) 29/46+	0/46-
Average YRS Service	(4) 6/46+	1/46-
Average YRS Service SQ	1/46+	(2) 6/46-
ADM	(6) 34/46+	0/46-
ADMSQ	0/46+	(3) 23/46-
AIE/WADM	(7) 23/46+	0/46-
Graduation Rate	(6) 41/46+	0/46-
Attendance Rate	(2) 45/46+	0/46-
% Economically Disad	0/46+	44/46-
% Black & Hispanic	0/46+	46/46-
% IEP	0/46+	45/46-
Strike*% Economically Disad	0/46+	(1) 2/46-
Strike* % Black & Hispanic	1/46+	(3) 5/46-
Strike*%IEP	(1) 1/46+	(2) 2/46-
Average Adjusted R^2 = .5591		

In Tables 1 through 3, the parentheses contain the number of coefficients that attained significance only at the .1 level. (The absence of parentheses indicates none of the coefficients were significant at the .1 level.) The other numbers preceding a "+" or "-" indicate the total number of coefficients attaining significance at all levels (.1, .05, or .01 or greater) and after the slash, the total number of regressions. At the bottom of each table is the average adjusted R^2 for all the regressions summarized by the table.

Table 1b:		
Dep Var: PSSA % ADV & PROF (46 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
Duration (2 Yrs)	(2) 5/46+	0/46-
Average BU Salary	(6) 23/46+	0/46-
Masters	(6) 25/46+	0/46-
Average YRS Service	(4) 7/46+	1/46-
Average YRS Service SQ	1/46+	(1) 6/46-
ADM	(9) 34/46+	0/46-
ADMSQ	0/46+	(2) 23/46-
AIE/WADM	(7) 23/46+	0/46-
Graduation Rate	(5) 41/46+	0/46-
Attendance Rate	(2) 45/46+	0/46-
% Economically Disad	0/46+	43/46-
% Black & Hispanic	0/46+	46/46-
% IEP	0/46+	46/46-
Duration*% Economically Disad	2/46+	4/46-
Duration* % Black & Hispanic	1/46+	(4) 6/46-
Duration*%IEP	0/46+	(1) 2/46-
Average Adjusted R^2 = .5596		

Table 1c:		
Dep Var: PSSA % ADV & PROF (46 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
Multiyear Strike Dummy	(1) 2/46 +	(2) 3/46 -
Average BU Salary	(5) 21/46+	0/46-
Masters	(5) 27/46+	0/46-
Average YRS Service	(1) 4/46+	1/46-
Average YRS Service SQ	(1) 2/46+	(2) 6/46-
ADM	(8) 34/46+	0/46-
ADMSQ	0/46+	(4) 24/46-
AIE/WADM	(6) 23/46+	0/46-
Graduation Rate	(5) 40/46+	0/46-
Attendance Rate	(2) 45/46+	0/46-
% Economically Disad	0/46+	43/46-
% Black & Hispanic	0/46+	46/46-
% IEP	0/46+	45/46-
Strike*% Economically Disad	2/46+	(1) 6/46-
Strike* % Black & Hispanic	(2) 5/46+	3/46-
Strike*%IEP	4/46+	0/46-
Average Adjusted R^2 = .5590		

Table 2a:		
Dep Var: PSSA % ADV & PROF (30 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
2-YR Strike Dummy	(1) 2/30+	0/30-
Average BU Salary	(3) 4/30+	0/30-
Masters	(4) 13/30+	0/30-
Average YRS Service	2/30+	(4) 5/30-
Average YRS Service SQ	(2) 3/30+	(1) 3/30-
ADM	(3) 11/30+	0/30-
ADMSQ	0/30+	(1) 7/30-
AIE/WADM	(2) 4/30+	0/30-
2001 PSSA % Prof & Adv	30/30+	0/30-
Graduation Rate	(3) 12/30+	0/30-
Attendance Rate	(2) 23/30+	0/30-
% Economically Disad	0/30+	(2) 18/30-
% Black & Hispanic	0/30+	(2) 28/30-
% IEP	0/30+	29/30-
Strike*% Economically Disad	(1) 2/30+	1/30-
Strike* % Black & Hispanic	0/30+	(2) 4/30-
Strike*%IEP	0/30+	(1) 1/30-
Average Adjusted R^2 = .6350		

Table 2b:		
Dep Var: PSSA % ADV & PROF (30 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
Duration (2 Yrs)	(1) 2/30+	0/30-
Average BU Salary	(3) 4/30+	0/30-
Masters	(4) 13/30+	0/30-
Average YRS Service	2/30+	(4) 5/30-
Average YRS Service SQ	(2) 3/30+	(1) 3/30-
ADM	(3) 11/30+	0/30-
ADMSQ	0/30+	(1) 7/30+
AIE/WADM	(2) 4/30+	0/30-
2001 PSSA % Prof & Adv	30/30+	0/30-
Graduation Rate	(3) 12/30+	0/30-
Attendance Rate	(2) 23/30+	0/30-
% Economically Disad	0/30+	(2) 18/30-
% Black & Hispanic	0/30+	(2) 28/30-
% IEP	0/30+	29/30-
Duration*% Economically Disad	(1) 2/30+	1/30-
Duration* % Black & Hispanic	0/30+	(2) 4/30-
Duration*%IEP	0/30+	(1) 1/30-
Average Adjusted R^2 = .6350		

Table 3a:		
Dep Var: % ADV & PROF ('06-'07) - % ADV & PROF ('05-'06) (14 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
2-YR Strike Dummy	0/14+	(1) 1/14-
Average BU Salary	0/14+	(1) 1/14-
Masters	0/14+	(1) 1/14-
Average YRS Service	0/14+	0/14-
Average YRS Service SQ	0/14+	0/14-
ADM	0/14+	0/14-
ADMSQ	0/14+	0/14-
AIE/WADM	1/14+	1/14-
Graduation Rate	(1) 1/14+	(1) 3/14-
Attendance Rate	(2) 2/14+	0/14-
% Economically Disad	(2) 4/14+	0/14-
% Black & Hispanic	0/14+	1/14-
% IEP	3/14+	5/14-
Strike*% Economically Disad	1/14+	1/14-
Strike* % Black & Hispanic	0/14+	0/14-
Strike*%IEP	(1) 1/14+	(1) 1/14-
Average Adjusted R^2 = .0200		

Table 3b:		
Dep Var: % ADV & PROF ('06-'07) - % ADV & PROF ('05-'06) (14 Tests)		
Independent Variables	Coefficients Significant at: (.1), .05, or .01 levels	
Duration (2 Yrs)	0/14+	(1) 2/14-
Average BU Salary	0/14+	0/14-
Masters	0/14+	(1) 1/14-
Average YRS Service	0/14+	0/14-
Average YRS Service SQ	0/14+	0/14-
ADM	0/14+	0/14-
ADMSQ	0/14+	0/14-
AIE/WADM	(1) 1/14+	1/14-
Graduation Rate	(1) 1/14+	(2) 4/14-
Attendance Rate	(2) 4/14+	0/14-
% Economically Disad	(2) 4/14+	0/14-
% Black & Hispanic	0/14+	1/14-
% IEP	3/14+	4/14-
Duration*% Economically Disad	(1) 1/14+	0/14-
Duration* % Black & Hispanic	0/14+	0/14-
Duration*%IEP	(1) 1/14+	0/14-
Average Adjusted R^2 = .0204		

Table 4a				
	Graduation Rate		Attendance Rate	
Dependent Variables	Coefficients Significant		Coefficients Significant	
	at: (.1), .05, or .01 levels		at: (.1), .05, or .01 levels	
% Advanced & Proficient	4/4+	0/4-	4/4+	0/4-
2-YR Strike Dummy	0/4+	0/4-	1/4+	0/4-
Average BU Salary	1/4+	0/4-	0/4+	0/4-
Masters	0/4+	0/4-	0/4+	0/4-
Average YRS Service	0/4+	0/4-	0/4+	3/4-
Average YRS Service SQ	0/4+	0/4-	0/4+	0/4-
ADM	4/4+	0/4-	0/4+	0/4-
ADMSQ	4/4+	0/4-	0/4+	0/4-
AIE/WADM	3/4+	0/4-	1/4+	0/4-
% Economically Disad	0/4+	3/4-	0/4+	4/4-
% Black & Hispanic	0/4+	4/4-	0/4+	4/4-
% IEP	0/4+	0/4-	(1) 3/4+	0/4-
Strike*% Economically Disad	0/4+	1/4-	0/4+	1/4-
Strike* % Black & Hispanic	0/4+	0/4-	1/4+	0/4-
Strike*%IEP	0/4+	0/4-	0/4+	1/4-
Average Adjusted R^2 =	0.4303		0.4891	

Table 4b				
	Graduation Rate		Attendance Rate	
Dependent Variables	Coefficients Significant		Coefficients Significant	
	at: (.1), .05, or .01 levels		at: (.1), .05, or .01 levels	
% Advanced & Proficient	4/4+	0/4-	4/4+	0/4-
Duration (2 Yrs)	(1) 1/4+	0/4-	1/4+	(1) 1/4-
Average BU Salary	1/4+	0/4-	0/4+	0/4-
Masters	0/4+	0/4-	0/4+	0/4-
Average YRS Service	0/4+	3/4-	(1) 2/4+	0/4-
Average YRS Service SQ	(1) 3/4+	0/4-	0/4+	2/4-
ADM	4/4+	0/4-	0/4+	0/4-
ADMSQ	4/4+	0/4-	1/4+	0/4-
AIE/WADM	(1) 4/4+	0/4-	1/4+	0/4-
% Economically Disad	0/4+	3/4-	0/4+	4/4-
% Black & Hispanic	0/4+	4/4-	0/4+	4/4-
% IEP	0/4+	0/4-	2/4+	0/4-
Duration*% Economically Disad	0/4+	0/4-	0/4+	1/4-
Duration* % Black & Hispanic	0/4+	(1) 1/4-	(1)1/4+	1/4-
Duration*%IEP	0/4+	0/4-	1/4+	1/4-
Average Adjusted R^2 =	0.4355		0.4913	

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[1] The PSSA testing program dates to 1992. Since that time the purpose, scope, format, and content of the assessments have undergone several changes (see, Data Recognition Corporation 2005b: 1-5).

[2] Although the PSSA tests began in 1995-96, it was not until after the passage of the reauthorization of the Elementary and Secondary Education Act (ESEA) known as "No Child Left Behind" (NCLB) Act of 2001 that states were required to report their assessment results broken down by selected demographic categories. Pennsylvania began this form of reporting with the 2001-02 test year.

[3] The Tables with "a" following the table number use the 2-year strike dummy variable, the "b" tables use the 2-year duration variable, and the "c" table uses the multiyear strike dummy.

[4] In 2005, Pennsylvania's State Board of Education adjusted the cut scores for existing PSSA tests after undertaking a new standards setting study. This project was undertaken due to changes made in the assessment anchors, definitions of the performance levels, and in order to align the existing 5th, 8th, and 11th grade performance levels with those of the newly added 3rd, 4th, 6th, and 7th grade tests (Data Recognition Corporation, 2005a).

[5] Unfortunately, individual student level data were unavailable, so we could not estimate the relationship between teachers' strikes and changes in student's year-to-year performance. (The latter is not to be confused with achievement growth.) Instead, available data allowed us to examine the relationship between teachers' strikes and the changes in test performance by different cohorts of students passing through each tested grade level. It is of interest to see if teachers' strikes have a detectable influence on what has been a general pattern of annual improvement as demanded by NCLB's requirement for districts to make Adequate Yearly Progress.

[6] http://www/paayp.com/state_report.html

[7] Although 40 of the interactions produced results that did not achieve statistical significance, 27 of the coefficient signs were positive.