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An empirical study of public school teacher strike activity, 1972-1980

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by

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I. INTRODUCTION

The past twenty years have witnessed a rapid increase in the number of strikes taking place in the public sector of employment. In the year 1962, President Kennedy signed into law Executive Order 10988, which made it legal for federal employees to collectively bargain over issues pertaining to working conditions. The law did not allow bargaining over wage and salary issues. Many state and local governments soon followed with statutes of their own concerning this issue of public bargaining rights. Each state is unique in this respect as to the degree of bargaining and to what issues may legally be subject to the bargaining process.

Public employee strikes are opposed on the grounds that they are threats to the public safety. This issue is not without its critics, who charge that strikes by certain professions, such as health care professionals, are threats to the public safety, regardless of whether these employees work for public or private agencies. The critics charge that it is the nature of the work that determines the threat to public safety, not whether the work is performed at a public or private entity (19, p. 184). The issue of public sector strikes has become an increasingly important issue over the past two decades since it affects the average citizen directly at the most personal level: the community in which they live.

Public strikes are unique in many respects when compared with strikes in the private sector. A public employer cannot close its doors and move to another region of the country with a more favorable economic or political climate. An additional factor to consider is that public employee unions hold an advantageous position over private unions in that, when

negotiating settlements, public employees can attempt to influence the outcome through political process as voters and lobbyists (19, p. 184).

Many measures of determinants of strike activity in general do not apply to the public sector. Measures such as profits and productivity are either nonexistent or difficult to measure when considering the public sector separately. Work stoppages in the public sector are usually larger in magnitude than those in the private sector, since the former usually involve larger employee units in metropolitan areas (32, p. 30).

William Torrence (25) states that one reason for the growing number of strikes in the public sector is the relative inexperience of public officials in the area of collective bargaining. Since public sector strike activity is a relatively recent problem, it is thought that public officials are lacking experience in this area compared to their counterparts in the private sector, and this lack of experience contributes to conflicts that are not properly dealt with, leading to increased strike activity.

Joseph Krislov (11) found that the majority of strikes involving public employees were concentrated among sanitation employees, utility employees, and educational employees.

This study will focus on public school teacher strikes, which, as a group, are involved in more work stoppages than any other group of public employees (16, p. 131). Teachers are not only the largest single group of unionized public employees, but also hold the distinction of being the largest group of professionals which are unionized.

The present economy is moving away from one which is industrially based, to an economy in which service industries are gaining an increasingly important role. As the industrial base of U.S. workers shrinks in proportion to that of other occupations, the unions which are dependent on industrial workers, such as the AFL-CIO, will be forced to look to the service and public sectors of employment as new areas for potential organization. Successful organization of public school teachers allows unions to make serious inroads into two areas which, for a long time, were nonunion: those of public and professional employees.

Two major labor organizations represent teachers: the American Federation of Teachers (AFT), and the National Education Association (NEA). The NEA does not have national control over its members. State and local affiliates act independently with the NEA providing assistance only when specifically requested. The NEA is by far the largest teacher organization in the United States, representing approximately two-thirds of all public school employees, of which 85 percent are classroom teachers.

The rival organization (AFT) has only about one-third the membership of the NEA, but has the AFL-CIO as its parent organization. The AFL-CIO has given its support to the AFT, since the successful organization of teachers may improve the image of unions in the eyes of other white collar employees. Although membership data concerning these organizations are not always available, it is believed that organizational rivalry between the AFT and the NEA may be a contributing factor to the increase in public school strike activity.

Teaching, as a profession, has lost much of its appeal in the past few decades. Budget considerations in local municipalities have forced school districts to economize in many areas, including wages of their employees. The product which teachers produce is not tangible and is, therefore, an easy target when considering cuts in a local budget. These budget cuts have resulted in increased classroom size and greater workloads for the teaching professional without a corresponding increase in salaries in relation to other groups of professional employees in our society (24, p. 92). As a result, teachers in public school systems have become more alienated as an employee group; hence, the need for them to act collectively to voice their concerns.

The purpose of this study is to attempt to identify the major determinants of strikes and work stoppages among public school teachers. Previous investigations concerning this topic have lead, for the most part, to unsatisfactory results. Either the specified variables were not consistent as to sign or the coefficients of these variables were not significant as determinants of teacher strikes and work stoppages.

The present study will employ a combined cross-sectional and time-series analysis which takes into account a variety of determinants of strike activity using data for each of the fifty states and the District of Columbia over the period 1971-1980. The rationale for choosing this time frame is that it is the most recent period for which a full set of data can be obtained.

II. REVIEW OF LITERATURE

This chapter will look into the general theory of strikes, why they take place, and examine some of the empirical studies concerning these issues. In order to determine why strikes take place, it is necessary to look at the theory of strikes and some empirical investigations as to the possible reasons for strikes and work stoppages.

The most often-cited theory of strikes is that which is proposed by J. R. Hicks (8). Hicks' theory of strikes is based on the concept of "faulty negotiation" (8, p. 146). There is a divergence of expectations between what a firm offers and what the union offers in response. Neither offer is initially expected to be accepted by the other party, but there exists an equilibrium settlement which will satisfy both parties. However, if this equilibrium is not met, a strike will result, since the parties have failed to come to terms.

An employer may lose profits during a wage conflict from either of two alternatives. The employer may grant a real wage settlement that is higher than the previous real wage received by the workers. This will lower profits if worker productivity does not increase by more than the real wage increase, assuming that product price and demand remain constant. Alternatively, the employer may refuse the proposed increase in the real wage, incur a possible strike, and lose profits from the work stoppage that would have been realized if the strike had not taken place. Similarly, an employee must weigh the consequences of striking and receiving no pay with the hope that the final settlement will make up for this loss, or the employee may accept an initial wage offer which is less than what was

expected. Both the employer and employee must weigh the opportunity cost of their decisions, including the possibility of job loss for the worker and bankruptcy for the firm (see Figure 2-1).

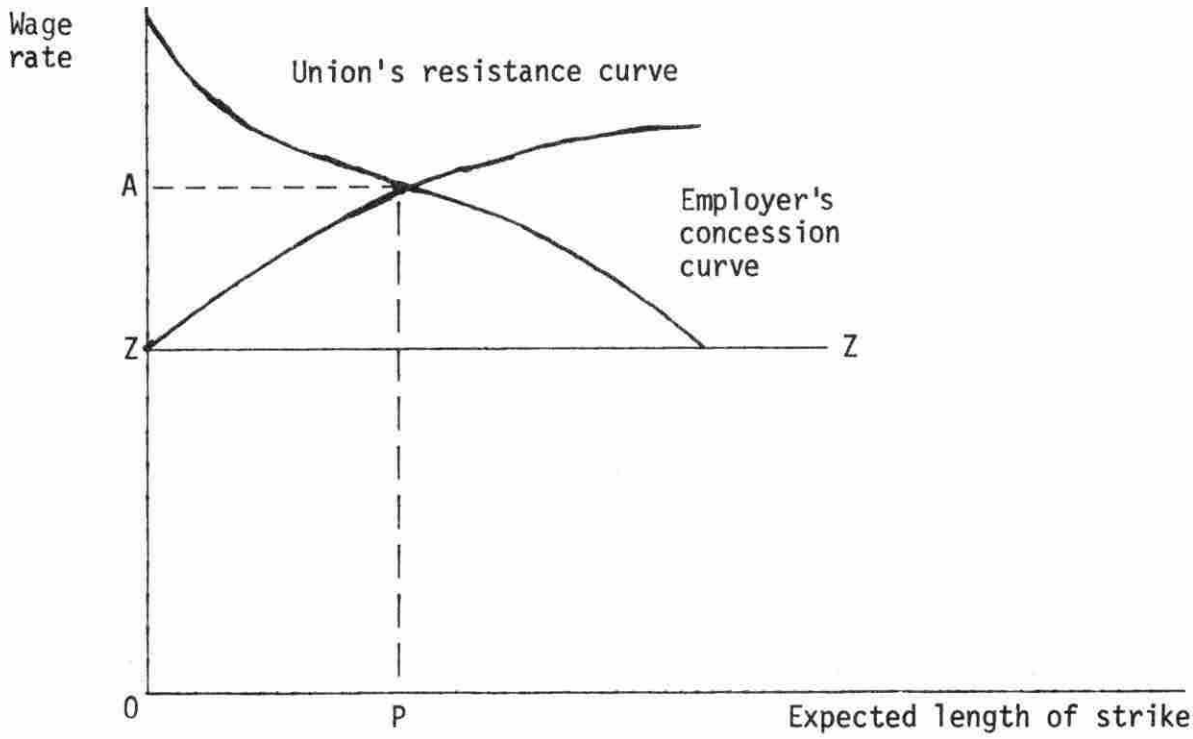

Figure 2-1. Hicks' strike model

The segment OZ is the wage an employer would pay if not constrained by the union. At time zero, there is a divergence in expectations between the two parties. As time progresses, an employer may be willing to grant a higher wage because the opportunity cost of doing so is less than the cost of a continued work stoppage. The union's expectations decrease over time as the opportunity cost of a continued work stoppage outweighs the

potential increase in wages that may result from continuing the strike. Therefore, the strike acts as a mechanism to bring the two parties into agreement, resulting in a wage OA only after a period of time OP which is necessary in order to force the two parties into agreement. Because of faulty negotiations at the initial stages, the strike acts as a device through which an equilibrium can be reached. This equilibrium will vary with the relative opportunity costs of the two parties involved. The union's resistance curve will depend on a number of factors, such as the size of the strike fund, savings of members, and the attitude of others not involved. The employer's concession curve depends on the relative cost of concession and resistance (8, p. 154). During strong economic periods of high employment, the employer's resistance is not as strong, since the opportunity cost of holding out is higher because of lost revenues from not producing.

Orley Ashenfelter and George Johnson (1) expand on Hicks' basic theory by adding a third party to the negotiating process. They state that union leadership objectives are accomplished by satisfying their rank and file members. Therefore, three parties are involved in the process: management, union leadership, and rank and file union members. Ashenfelter and Johnson state that a breakdown in negotiations can only occur when the parties involved are irrational in their expectations. If a given wage offer is less than what is expected by the rank and file, the union leadership has two options. It can sign a lesser agreement which causes hard feelings among the rank and file, or it can strike. The strike is the preferred mechanism, since it appears to the rank and file as though the

union is fighting on their behalf. A strike may be needed in order for the rank and file membership to realize that their initial expectations were not rational (1, p. 37). That is, the union leadership and management may have rational expectations concerning the negotiations, but fail to reach agreement because the union leadership must attempt to satisfy the rank and file whose expectations are irrational. Therefore, the strike acts to force the rank and file membership to face reality. The analysis of strikes is similar to the assessment made by Hicks (8). Over time, the rank and file are forced by economic necessity to lower their expectations concerning a final settlement. Only by the act of striking, and thereby losing their present income, will the rank and file face the reality of the situation.

Ashenfelter and Johnson also looked at the possible determinants that affect whether or not the parties will reach agreement. These factors are broken down into objective and subjective categories. Elasticity of labor demand, state of product demand, and the capital-labor ratio are objective factors which will influence the bargaining position of the firm (1, p. 36). If a firm faces an inelastic demand for labor, it is more likely to be willing to pay a higher wage, since it may not be able to substitute other workers or equipment in the vacated positions. If the demand for the product produced by the firm is at a low point, the firm may be willing to resist the union, since there is not sufficient incentive for the employer to settle. The capital-labor ratio also affects the willingness of management to settle, since firms with high ratios may be able to substitute

supervisory workers for short periods of time and, thereby, continue operations. Subjective factors include the assessment of bargaining strategy and the attitudes toward the risk of striking by both union and management.

Additional results from Ashenfelter and Johnson suggest that strike activity is a function of a moving average of the real wage received by workers. That is, an increase in real wages was found to lead to a reduction in strike activity. The timing of contract expirations alters the effect of real wages as determinants of strike activity in any given year. At times, the increase in real wages offered by employers may be greater than what the rank and file members expect. At other times, the employer's offer of an increase in real wages may be below rank and file expectations. Therefore, use of a lagged wage model which incorporates the change in real wages over a two-year period is thought to be a more reliable measure of the true effect of a change in real wages on the level of strike activity than using a single period real wage change.

Contract expirations were also found to be determinants of seasonal strike activity. Trade unions try to gear their contract expirations to times of the year when demand for their services is high and avoid expirations when demand is low. This helps explain why spring and summer seasons experience more strike activity than do fall and winter (1, p. 42).

Daniel Mitchell (14) also stresses the importance of contract expirations on the level of strike activity. Two important variables are associated with contract expirations. One deals with the relationship between a worker's past wage increase compared to others in that industry.

The other variable measures the amount of real wage increase regardless of what other firms are paying (14, p. 124). Although the two variables are highly correlated, the results of this study indicate a negative relationship between strike activity and a real or relative wage gain by employees. The positive relationship between the number of strikes and the number of contract expirations can be used to explain the tendency for employers to negotiate multi-year agreements in order to reduce the frequency of costly work stoppages (14, p. 126).

Another study investigating the relationship of contract expirations and strike activity was conducted by Sean Flaherty (7). This study focused on a relatively recent time period from 1961 to 1981, and found results that were in agreement with those found by Mitchell (14). Flaherty's (7) findings were even more dramatic, since he found that approximately two-thirds of strike activity was related to contract expiration. More important was the difference in the determinants of strike activity when considering contract renegotiation strikes and intracontractual strikes separately. Eighty-five percent of renegotiation strikes were fought over economic issues, but only 10 percent of intracontractual strikes involved economic issues. In addition, the average duration of the strike was 15 days when renegotiating the contract, while duration was less than 3 days during intracontractual disputes (7, p. 20). Another finding of the study was that the unemployment rate had a significant effect on contract expiration strikes but had little effect on intracontractual strikes. Since intracontractual strikes are short in duration, it seems logical

that they would not be affected by the availability of part-time work or the size of the strike fund (7, p. 23).

A study by Albert Rees (18) relating strike activity to the business cycle found that the primary cause of cyclical strike movement is due to a change in the propensity of workers to strike (18, p. 380). The condition of the labor market with respect to the amount of unemployment was found to exhibit a high degree of correlation to the business cycle. Therefore, during high periods of unemployment the business cycle would be at a low point and, likewise, the propensity of workers to strike would also be low. A rising level of employment offers unions the opportunity to exert additional pressure on the firm. Employers are reluctant to lose their relative position in an expanding market and will be more agreeable to the union's terms. Another factor to consider when employment is rising is that employees will have alternatives in the job market which lessens the ability of an employer to replace a worker which, in turn, lowers the employer's resistance toward the union's demands (18, p. 381). Rees (18) concludes that strike activity closely follows the level of employment in the economy, but that eliminating cyclical variations in the business cycle will not eliminate strikes. Eliminating cyclical variations will diminish the importance of the relationship between strike activity and the unemployment rate, thereby increasing the importance of other determinants, resulting in a smoother trend of strike activity over time.

A study by David Britt and Omer Galle (2) illustrates the relationship between industry size and the frequency of strikes. Results of this study

show that strikes are positively related to size of the industry, but that the breadth of the work stoppage bears no relationship to industry size (2, p. 648). Unionization was found to be an important determinant of the nature of the strike. With unions present, the strikes tend to be more frequent, involve a greater number of workers, and are shorter in duration than strikes by nonunion workers. Industrial organizations are so large that the incentives for individual strike action are at a minimum. Collective action is an effective method to overcome this difficulty and this is the purpose for which unions serve. The size of the union does not change the nature of the conflict, but does affect the frequency with which strikes will occur (2, pp. 650-651).

A similar study concerning the effects of industries of differing sizes and production methods was conducted by Frederick Eisele (6). This study used an additional variable that relates the production method or manufacturing technique to the level of strike activity. Results indicate that industries which use a production line method have more frequent strike activity than industries using other production technqiues when industry size is held constant (6, p. 561). Although Eisele's (6) results are roughly in accord with Britt and Galle (2), a note of caution must be pointed out. That is, when an industry grows in size, changes in the make-up of the organization take place which may change the original dimensions of the firm. This may cause one to make faulty cause and effect conclusions regarding the relationship between size or method of production with frequency of strikes. There appeared to be a large variation in the groups, suggesting that many plants seem to be more strike-prone regardless of the size or method of production (6, p. 571).

Bruce Kaufman (9) looks at the interindustry differences in the level of strike activity and finds that a large portion of total strike activity can be attributed to a small number of industries. Mining, though small as a percentage of the workforce, makes up a large portion of strike activity. In contrast, public employees represent a large percentage of union members but exhibit a small percentage of total strikes (9, p. 48). Findings suggest that durable good industries react to changes in the rate of inflation with more frequent strike action than do industries producing nondurable goods. However, all industries exhibit positive and significant relationships when comparing strike activity with independent variables, such as inflation or the rate of unemployment (9, pp. 50-51). This finding is in agreement with previous studies done on the industry level but extends the relationship to all industries. No single pattern of secular trends in strike activity was found to exist when considering only inflation or the unemployment rate. This suggests that other factors, such as industry relocation, foreign competition, or changing laws affecting specific industries, may be more influencial in predicting strike activity in an interindustry study (9, p. 56).

Robert McLean (13) also investigated interindustry differences in strike activity for the United States in general. This study found that wage demands were not significantly related to the relative wage position in an industry. This finding is not in agreement with other studies on this relationship and caution should be exercised when considering the relative wage position as an independent variable to predict strike activity. However, results did support the hypothesis that workers that received

high wages in the past expect high wages in future contracts (13, p. 106). A somewhat surprising result was that productivity had little influence on the level of strike activity, although productivity may have been previously incorporated in management's initial wage offer (13, p. 106). Southern industries were found to be important determinants of increased strike activity. This finding runs counter to what would be expected, but may be explained by the fact that many industries that have relocated in the South may be relocating because of industrial disputes previously encountered in northern states. That is, these southern industries are simply bringing their labor problems along with them when they relocate in the South. The final result of this study confirmed the hypothesis that industries whose work force consists of a large percentage of female employees are less likely to experience strike activity (13, p. 108).

Bruce Kaufman (10) states that factors other than purely economic are needed as determinants of strike activity. Psychological factors, such as militance of workers, style of union leadership, and public opinion towards unions are all important determinants (10, p. 483). A problem with using psychological factors is that it is not clear how one would empirically measure such factors. Kaufman does not attempt to measure these factors, but simply states that they account for a portion of the variability in strike determination models. Kaufman did examine the effect of interunion rivalry on the propensity to strike. This rivalry increases the number of strikes for two reasons. Union leaders who face rivalry from other unions must demonstrate to the rank and file that their union is the better one. The effort put forth in both organizaing and bargaining is related to the amount of competition they face from rival unions. Another reason

is the increased number of jurisdictional disputes, meaning that the union leaders pursue new members and better contracts than they would in the absence of the rivalry. This results in more strikes (10, p. 484). Kaufman found no effect between the political party in office and the degree of strike activity in the postwar period. In the post World War II period, the level of organization and the legal system regarding employee rights have remained relatively stable. Thus, according to Kaufman, economic factors remain as the strongest influence on strike activity (10, p. 489).

Arie Shirom (20) examines the premise that management bargaining strategies associated with perception of an advantageous outcome of a strike will influence management's behavior in future labor conflicts. An important indicator of a union's power is the ability to disrupt the operation of the firm. On the other hand, the ability of management to continue operations during a work stoppage is an indication of their power. The emphasis is on management's point of view, since it is believed that unions react to the policies and practices of management (20, p. 46). Interviews with the employer's chief negotiator for the fifty-one strikes studied in this investigation found that the majority of the strike settlements favored management. An operative strategy was employed in approximately two-thirds of the cases with the struck plants actually operating in about one-third of the situations (20, p. 49). The operating strategy, assumed to predict management's perceived advantage, predicted a significant fraction of the settlements that were advantageous toward the management side of the conflict.

Neil Snarr (21) found that certain characteristics were more likely to be found among workers who strike. High pay, high skill level, being male,

and being married were all found to be characteristics that were related to strike activity. Age and seniority were not found to be significant as determinants of strike activity. Strike activity was found to be positively related to having children and having a nonworking spouse. This study tends to indicate that active union members have more at stake in their job situation than do inactive union members (21, p. 374).

Joseph Krislov (11) examined public sector strike activity and found that workers who formed a homogeneous group and were somehwat isolated from other work groups had a higher propensity to strike (11, p. 90). Although Krislov maintains that the majority of public sector strikes occur over economic issues, he does investigate other determinants of strike activity. Krislov observed that states enacting no-strike laws for their public employees experience a decline in the number of strikes after enactment of the statute, but that some states without these laws also experienced a decline in strike activity. Therefore, the exact effect of these no-strike laws could not be determined.

James Young and Betty Brewer (33) continued the research of Krislov (11), but came to different conclusions. Economic issues accounted for 55 percent of strike activity, with approximately one-third of the strikes resulting from bargaining impasses (33, p. 360).

William J. Moore (15) examined the effect of right-to-work legislation on the level of strike activity. Moore states that it is incorrect to assume that the passage of right-to-work laws weakens membership or bargaining power of unions because right-to-work legislation may simply be a reflection of strong anti-union attitudes of a given state. Therefore, a negative correlation between strike activity and right-to-work laws may

reflect strong anti-union attitudes of a given state rather than any strike deterring aspects of the law itself. Moore tests for the possibility of a simultaneous equation bias on the right-to-work variable and finds that, when using a two-stage least squares procedure, the negative coefficient on the right-to-work variable is drastically reduced, thereby confirming Moore's hypothesis.

Public attitudes toward striking public employees will also have an effect on the number of strikes, since it is thought that local attitudes influence the public employee's strike propensity as a contributing environmental factor (12).

John Burton and Charles Krider (3) conducted an extensive study into the determinants of strike activity in the public sector. Three factors were thought to be involved in determining the incidence of strikes in a given state: the state environment including both economic and political factors; the extent of private sector unionization; and the statutory policy of the state (3, p. 155).

These factors were used as a general framework for developing a series of independent variables thought to be important as determinants of strike activity. The results of this study were not very conclusive. Correlation coefficients changed sign when comparing one year with another, leading to problems in interpreting results. In addition, many of the independent variables used in the study were not found to be significant determinants of strike activity. Public policy variables were inconsistent determinants of strike activity, but should not be totally discounted in future studies, since many of the policy variables were relatively recent in their

enactment and may not have been in effect long enough to affect strike activity (23, p. 178).

Previous studies in the area of determinants of public work stoppages, both in general and for teachers, have led to many contradictory results. This study, which will concentrate on public teacher work stoppages, will seek to overcome the deficiencies of prior investigations in an attempt to improve measures concerning the determinants of public teacher strike activity. Since previous studies had been done during periods of changing policies concerning public employee bargaining rights, it is thought that using data from the period 1972 to 1980 will result in improved findings, since sufficient time has passed to stabilize policy events enacted in the late 1960s and early 1970s. However, the absence of data prevents the study of the dynamics of the change in strike activity which occurred from the early 1960s to the period of this study.

III. MODEL FORMULATION

This chapter will be used to formulate a model which will attempt to identify the major determinants of strikes and work stoppages involving public school teachers. The investigation will focus on a nine-year period covering the years 1972 through 1980, using cross-sectional data which include observations from all fifty states and the District of Columbia. The study is limited to this time period because of problems with the data in years prior to 1972 and the absence of publicly available data after the year 1980.[1] This chapter will include three sections: Section A will discuss the dependent variables; Section B will focus on the independent variables considered to be an important influence in public school teacher strike activity; and Section C will be used to formulate a model of strike activity involving public school teachers.

A. Dependent Variables

The purpose of this model is to attempt to determine the number of public sector teacher strikes which will take place in a given year. The emphasis of this investigation is on the number of strikes. However, it may be useful to also examine some alternative measures of strike activity. A second measure of strike activity is the breadth of the strike as measured by the number of workers involved in the strike. A third measure is the duration of the strike -- that is, a dependent variable designed to capture the number of days which workers are idle as a result of the work

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[1]Data, broken down by state, on the level of strike activity of public school teachers are not available for years prior to 1972.

stoppage. Each of these variables are important as measures of the overall impact of a strike. Since this investigation is concerned only with strikes involving public school teachers, all measures used in this investigation regarding teacher based variables pertain to public school teachers only. The data source used for the dependent variables selected in this study was "Work Stoppages in Government," published by the U.S. Department of Labor (30). Three dependent variables will be used to measure the level of public teacher strike activity.

1. Number of stoppages

A strike is defined by the Bureau of Labor Statistics as a temporary stoppage of work by a group of employees to express a grievance or enforce a demand. All stoppages, whether or not authorized by the union, legal or illegal are counted providing that the stoppage lasts at least one full day or shift and involves at least six full-time employees.

2. Number of workers involved

This variable was selected as a measure of the magnitude of the work stoppage. Its inclusion as a dependent variable is an attempt to differentiate between relatively major and minor work stoppages in a given state or district. A state which experiences many teacher strikes may bias the results of this study if the magnitude of these strikes is small relative to states which experience small numbers of work stoppages, but involve several thousand employees. The figure used for the number of public school teachers involved in a strike is the maximum number actually made idle in the establishment or establishments directly involved. No distinction is made between the active participants in the strike and those

unable to work because of the strike activity. Therefore, the inclusion of this variable will measure the number of full-time public school teachers prevented from working because of a strike action during a given calendar year.

3. Work-days idle

This measure is used as an indication of the duration of the work stoppage. As such, it has a direct correlation to the other dependent variables used in the model since the value of this variable is calculated as follows: workers involved multiplied by workdays lost per worker equal total days idle. A work-day is defined as a full-time worker's daily period of employment. The number of work-days idle is also measured as those occurring in a given calendar year.

These dependent variables will be used in two forms of numerical values. One form will use the absolute value for each state or district. In this case, the number of public teachers in the state is controlled for on the right side of the equation. The other form will transform the dependent variables to "per teacher" measures by dividing the dependent variables by the number of public school teachers in each state. This normalized approach will hopefully eliminate the distortions which may be caused by population differences among the states and districts. This procedure transforms each of the dependent variables by means of transforming them into "per worker" units of measurement.

B. Independent Variables

Previous investigations of public strike activity have revealed that no single category of variables, such as economic or legal, are capable of determining strike activity. Therefore, a broad spectrum of possible strike determinants will be employed in this study. Four general categories of determinants are believed to affect the workplace with regard to the propensity of strike activity.

The degree of unionization in a given state is believed to have an impact on the workforce of a state, since it may be an indication of the population's attitude toward organized labor. In measuring the degree of unionization for a particular state, one must take into account the general climate towards unions. Since this study is directed at public school teachers, a measure of their tendency to form collective bargaining units must also be considered.

Public sector legislation may affect the degree of strike activity in a given state, both directly, through prohibiting strikes, and indirectly, by means of legislation regarding bargaining rights of public employees. Therefore, measures concerning a state's legal environment with regard to public employee bargaining must also be considered.

Economic factors, both in general terms and specifically related to public school teachers, must also be taken into account. Factors, such as the rate of inflation or the rate of unemployment in a given state, are thought to be useful as an indication of a worker's propensity to strike in any given year. Consideration must also be given to factors which affect the public teacher's economic environment, such as the expenditures per pupil made in a state's public school system. An additional factor may be

the change in the real wage of public teachers, since it affects their relative standard of living when compared with others in the workforce.

One must also examine the demographic characteristics and teaching environment in a given state as an indication of the environment in which the given teacher operates. Factors such as the percentage of a state's population which is urbanized may be an indication of a worker's propensity to strike. In addition, factors such as the percentage of teachers in a given state who are female may affect strike propensity. The following variables were considered as primary determinants of public school teacher strike activity. These selected variables were categorized into four basic groups on the basis of theoretical causality.

1. Unionization

The degree of unionization in a given state is thought to be a significant determinant of the number of strikes which occur. A work group will be more inclined to strike if the group is unionized. The degree of unionization will also serve as a proxy for a state's general attitude toward unions. A state with a high percentage of its workforce unionized is thought to be more tolerant of unions and the strike mechanism as a method of voicing grievances than a state with a relatively low percentage of its workforce unionized. Variables thought to have an impact on the degree of unionization in a given state were further broken down into two categories.

a. General climate Variables considered in this category are those thought to reflect a state's overall attitude toward unions.

i) Percent of nonagricultural/nongovernment employees unionized (NONAG) This measure is considered to be a proxy which identifies those

states whose public attitude toward unionization is a positive one. It is thought that those states having a higher percentage of their workforce unionized will likewise experience more strike activity. This variable will also serve as a proxy for tastes of the workers with regard to unions and the degree of worker militancy in a given state. Both of these would be expected to increase with the percentage of union members in the state. Data for this variable were collected from the Statistical Abstract of the United States (27) and includes both public and private union membership. Data were available only for even years; odd years were linearly interpolated.

ii) Right-to-work (RTTOWK) The basic premise of right-to-work legislation is that no person may be denied, or excluded from, employment because of membership or nonmembership in a labor organization. Right-to-work laws are enacted on an individualized basis by each state. As of 1980, no major industrialized state had a right-to-work law in effect. Of the twenty states which have right-to-work laws in effect, nineteen were enacted during the late 1940s to early 1950s. Since that time, the situation has remained fairly stable, with Louisiana's 1976 enactment being the exception (4, p. 178). Right-to-work laws are thought to be indicative of a negative public attitude toward labor unions. Therefore, one would expect this negative attitude toward unions to carry over to a negative attitude toward strikes in general. As a result, one could expect a decrease in the frequency of strike activity for those states having right-to-work laws (see Table 3-1). These data will be measured by means of a dummy variable (dummy = 1) entered for each state which has a right-to-

work law in existence. The data source for this variable was the "Summary of State Policy Regulations for Public Sector Labor Relations" (31).

b) Teacher specific Two organizations are involved in the unionization of public school teachers. They are the NEA (National Education Association) and the AFT (American Federation of Teachers). Together, these organizations represent the majority of all public school teachers who are members of labor organizations. The NEA represents approximately 85 percent of all classroom teachers and far exceeds the number of teachers represented by its rival organization, the AFT. Unfortunately, this rivalry cannot be further examined, since the AFT, which is associated with the AFL-CIO, does not publicly reveal its membership on a state-by-state basis. Therefore, the NEA membership data will be used as a proxy for public school teacher unionization.

i) Number of NEA members (NEAMEM) This variable measures the absolute number of NEA members in each state or district. Since this measure is being used as a proxy for teacher attitudes toward unionization, it would be expected that, as NEA membership increases, the number of strikes would also increase. This variable will also be used as a per teacher measure; dividing each observation by the number of public school teachers in each state. Data for the measure were collected for each state for each year pertaining to this study from the *NEA Handbook* (17). Upon examination of this data, a measurement problem became apparent. That is, many states exhibited huge increases in membership in specific years. Further examination revealed that many of these large increases were due to

unification.[2] After identifying the states and years in which unification took place, an adjustment was made in an attempt to remove the unification bias. The adjustment method was based on using the one year change after unification to project back to the year before unification took place. After this adjustment was made, the prevailing yearly percentage changes were used in adjusting the data back to 1972.

2. Public sector legislation

This group of variables is included in order to control for a state's legal environment. This category will also examine the limitations which a state may impose on the resolution of bargaining disputes as evidenced by "no strike" provisions enacted by a given state's statute covering public employees. The vast majority of laws covering bargaining in the public sector were enacted during the late 1960s to early 1970s (see Table 3-1). Prior investigations into the area of public employee work stoppages found that legal determinants were, for the most part, not significant as determinants of public employee work stoppages. These prior studies were completed during the early 1970s. This may have been too early to allow the changes in state laws to be a factor which influences public work stoppages. Data collected for this category included legislation pertaining to public education labor laws in specific states. Where no public education statutes are in effect, the state's general public sector labor laws were used. The legal variables considered in this category were all measured

[2]Unification refers to the individual local NEA organizations becoming members of the national NEA organization. Before unification, local NEA chapter membership data was not reported unless the local chapter was a member of the national organization.

Table 3-1. State labor laws

State or district	Right-to-work (date enacted)	Mutual duty to bargain (date enacted)	Strikes prohibited (date enacted)	Strikes prohibited with stated penalty (date enacted)
Alabama	1953		1957	1979
Alaska		1972		
Arizona	1947			
Arkansas	1947		1958	
California		1972	1970	
Colorado			1976	1976
Connecticut		1969	1951	
Delaware		1970	1970	1970
District of Columbia		1970	1970	1970
Florida	1944	1973	1959	1959
Georgia	1947		1971	1971
Hawaii		1970		
Idaho		1971		
Illinois			1972	
Indiana		1973	1973	1973
Iowa	1947	1974	1974	1974
Kansas	1958	1970	1970	
Kentucky			1970	
Louisiana	1976			
Maine		1969	1969	
Maryland		1969	1969	1969
Massachusetts		1973	1963	1973
Michigan		1947	1947-68,1979	1947-68
Minnesota		1971	1971-78	1971-78
Mississippi	1954			
Missouri			1967	
Montana		1971	1971-74	1971-74
Nebraska	1947		1947	1947
Nevada	1952	1969	1969	1969
New Hampshire		1975	1975	

New Jersey		1941	1968	
New Mexico		1978	1972	1972
New York		1967	1967	1967
North Carolina	1947			
North Dakota	1947	1969	1969	
Ohio			1959	1959
Oklahoma		1971	1971	1971
Oregon		1963		
Pennsylvania		1970		
Rhode Island			1975	
South CArolina	1954		1970	
South Dakota	1947	1969	1969	1969
Tennessee	1947	1978	1957	1978
Texas	1947		1971	1971
Utah	1954		1960	1960
Vermont		1969		
Virginia	1947		1970	1970
Washington		1976	1971	
West Virginia			1970	
Wisconsin		1959	1959-78	1959-78
Wyoming	1963			

as dummy variables (dummy = 1) for the years that the law or statute is in effect. The data source used in compiling these measures was the *Summary of State Policy Regulations for Public Sector Labor Relations* (31).

a. Mutual duty to bargain (MDUTY) This variable identifies those states which have a mutual duty statute which requires both employees and employers to meet and confer over issues pertaining to the workplace. States which have mutual duty statutes should experience fewer stoppages, since the parties involved are forced by law to bargain. This statute should reduce strikes, since both sides will have an opportunity to air their grievances and attempt to reconcile their differences before a work stoppage occurs. An alternative hypothesis is that the presence of a mutual duty statute may be interpreted by the workforce as the right to go to an impasse in the bargaining process. If this interpretation is correct, the presence of a mutual duty statute may actually lead to an increase in strike activity.

b. Strikes prohibited (NOSTRK) The majority of states prohibit strikes by their public sector employees. However, not all of these states have statutes which specify what punishment, if any, a public employee on strike would receive. Prohibiting strikes without a stated penalty suggests that the laws are likely to be ignored. A preliminary investigation revealed no major difference in using only "prohibited with penalty" measures when compared with the broader "no strike" measure. Therefore, only the no strike measure was employed in this study, since it is a broader measure and thought to best capture the intent of the law. One would expect a decrease in public school teacher strike activity in states which expressly prohibit public sector strikes.

3. Economic factors

This group includes variables which affect the individual employee as an economic entity of society. Public school teachers, as well as others in our society, are greatly influenced by the economic environment in which we live. Economic fluctuations which cause changes in the level of unemployment or changes in the price level are thought to be major causes of employee unrest, since these factors affect the attitudes and perceptions of the individual relative to the society in which he or she lives. The following variables have been selected as being primarily economic in nature and have been further categorized as being either general economic factors or teacher specific economic factors.

a. General economic factors This group will include those factors thought to influence the general populace with regards to the propensity to strike in response to a changing economic environment. The change in the cost of living measured by means of the CPI (1967=100) will not be used as a separate determinant. Instead, all dollar-based variables will be standardized so that all are measured in real terms, thereby minimizing the inflationary bias.

i. Unemployment rate (UNEM) The level of unemployment in each state influences the bargaining power of the individual employee. During periods of relatively high unemployment, the bargaining position of the worker is seriously hampered, since the employers in that state have a larger pool of workers and, in some cases, need not be concerned with worker unrest. Attractive alternatives to present employment may not be available to the worker in question. There also exists a larger pool of

potential replacement workers should a work stoppage occur. Both of these factors should result in less strike activity during periods of high unemployment. An alternative hypothesis, relevant to the cross-section, may be that the level of strike activity is positively related to the level of unemployment. This situation may occur because of a possible cause and effect problem. That is, since most strike activity takes place in the more industrialized areas and, since industrial areas typically experience higher levels of unemployment, it may be that a higher rate of unemployment is associated with increased strike activity. Data related to the state's yearly unemployment rate were obtained from the *Statistical Abstract of the United States* (27).

b. Teacher specific economic factors This group will include those economic factors thought to be related to the level of strike activity in the teaching profession.

i) Expenditure per pupil (EXPPUP) It is thought that a state which contributes a large expenditure per pupil has a positive attitude toward education and will, therefore, provide better salaries and teaching environments than those states with low expenditures per pupil. If this hypothesis is correct, one would expect strike activity in the teaching profession to be negatively related to the state's expenditure per pupil. An alternative hypothesis is based upon the assumption that high expenditures per pupil are associated with states having a higher per capita income, such as those found in states with a more urbanized population. If this hypothesis is correct, one would assume higher expenditures per pupil to be positively related to the more frequent strike activity which is typical in the more industrialized states. This variable will be

transformed into real terms by means of the CPI to correct for any inflationary bias. The data source used in the collection of this measure was the *Digest of Educational Statistics* (29). The measure for the year 1980 was linearly extrapolated, since the data were not yet publicly available.

ii) Lagged wages (LAG2) Teacher wages are a major theoretical cause of strike actions. As the price level increases without a corresponding increase in nominal wages, the real wage declines. This erosion of real wages is hypothesized to be a major cause of teacher strikes. However, as Ashenfelter and Johnson (1) point out, the relationship between the real wage and strike activity is more than a single year relationship. Since contract expirations may not occur on an annual basis, it is thought that a two period lagged wage model would be a more reasonable approach to use when considering the effect that real wages have on the level of strike activity. The following lagged wage model, used by Ashenfelter and Johnson (1), is presented below.

$$\text{Lagged Wage} = \tfrac{1}{2}(Y_1 - X_1) + \tfrac{1}{2}(Y_2 - X_2)$$

where:

Y_1 = Percentage change in nominal wages for the first period lag

$$\frac{\text{nominal wage}_t - \text{nominal wage}_{t-1}}{\text{nominal wage}_{t-1}} ;$$

Y_2 = Percentage change in nominal wages for the second period lag

$$\frac{\text{nominal wage}_{t-1} - \text{nominal wage}_{t-2}}{\text{nominal wage}_{t-2}} ;$$

X_1 = Percentage change in the CPI for the first period lag

$$\frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} ;$$

X_2 = Percentage change in the CPI for the second period lag

$$\frac{CPI_{t-1} - CPI_{t-2}}{CPI_{t-2}} .$$

This model specifies a one-year and two-year change in the real wage with each year having an equal weight as to the total effect. Data pertaining to this measure were compiled from the *Statistics of Public Elementary and Secondary Day Schools* (28). The measure for the year 1980 was linearly extrapolated since the data was not yet publicly available.

4. Demographic and teaching environment

This group of variables is thought to reflect the environment in which a teacher must work in a given state. The following variables are thought to be an indication of the working conditions and demographic characteristics of the state in which the teacher is employed. Most of these teaching environment variables were found to have little or no effect on public teacher strike activity (see Appendix A). However, the following variables were selected as possible determinants.

a. Percent SMSA (PCTSMSA) A SMSA (standard metropolitan statistical area) is defined as any county or group of contiguous counties which contains at least one city of 50,000 or more in population, except in New England states, where SMSA's are defined in terms of cities and towns rather than counties (26). This variable will be used to test the

hypothesis that teachers in a state with a more populous environment are more likely to experience strike activity than those teachers from less populous states. An explanation of this relationship is that a state with a large segment of its population located in urbanized areas is likely to have a large industrialized base which is typically associated with a greater degree of unionization and, hence, strike activity. The data source used in the collection of this data was the *Current Population Reports, Series P-25* (26). Data for the years 1979 and 1980 were repeated from the 1978 measures, since the 1980 census data reported a larger number of SMSAs than did the earlier reports, and using this recent information may lead to a nonuniform set of data.

a. Percent of female teachers (PCTFEM) Since females have traditionally been less inclined to participate in union activities, it seems reasonable to assume that a basic inverse relationship exists between the population of female teachers in a given state and the state's level of strike activity (24). Therefore, this variable will be used to measure the effect of differing state percentages of female public school teachers on the level of strike activity. It is expected that a state with a large percentage of female teachers will experience fewer strikes than a state with a relatively small percentage of female teachers. Data were available only for the years 1973, 1975, and 1980, from the *Digest of Educational Statistics* (29). The remaining years were linearly interpolated based on the available data.

c. Number of teachers (NTEACH) This varible is used to transform the dependent variables and the NEA membership variable to per teacher measures in order to eliminate the distortions which would be caused when

comparing states of differing populations. Without this transformation, state comparisons would be meaningless, since a very large state would be found to experience more strikes than would a smaller state, regardless of frequency rates. An alternative use of this measure is to use it as an additional independent variable. Data pertaining to this measure were collected from the *Digest of Educational Statistics* (29).

Appendix A contains a listing of additional variables considered to be determinants of public school teacher strike activity. These variables were eliminated from the model after a preliminary examination revealed that they displayed a degree of multicollinearity with variables already included in the model or that their inclusion added little, if any, additional explanatory power to the model.

C. Model Development

Table 3-2 summarizes the variables used in the following model, specifying the variable notation which was used along with the expected sign of the correlation coefficients. An early examination of the pooled residuals revealed the possibility of nonlinearity in the PCTSMSA and NONAG measures. The residuals were positive in the lower and higher bounds of these measures and negative in the middle of the grouping. This configuration of residuals may indicate that these measures may best be captured by use of a quadratic function. Therefore, two additional variables which square these measures will be added to the regression. A test of this specification will be incorporated in the model results chapter of this paper.

Table 3-2. Summary of variables used in the model

		Variable name	Variable notation	Expected sign
Dependent variables	1)	Number of stoppages	NSTOP	N.A.
	2)	Number of stoppages (per teacher)	NNSTOP	N.A.
	3)	Number of workers involved	NWKIN	N.A.
	4)	Number of workers involved (per teacher)	NNWKIN	N.A.
	5)	Number of days idle	DUR	N.A.
	6)	Number of days idle (per teacher)	NDUR	N.A.
Independent variables	1)	Percentage of nonagricultural employees unionized	NONAG	Negative
	2)	NONAG squared	NAGSQ	Positive
	3)	Right-to-work	RTTOWK	Negative
	4)	NEA members	NEAMEM	Positive
	5)	NEA members (per teacher)	NNEAMEM	Positive
	6)	No strike law	NOSTRK	Negative
	7)	Mutual duty to bargain	MDUTY	Positive or negative
	8)	Unemployment rate	UNEM	Positive or negative
	9)	Two period lagged wage	LAG2	Negative
	10)	Expenditures per pupil	EXPPUP	Positive or negative
	11)	Percent of population in SMSA	PCTSMSA	Negative
	12)	PCTSMSA squared	SMSASQ	Positive
	13)	Percent of female teachers	PCTFEM	Negative
	14)	Number of public school teachers	NTEACH	Positive

The model will be analyzed in two separate formats. A transformed approach will transform the dependent variables and the NEAMEM into "per public teacher" units by dividing each observation by the number of public school teachers. An alternative model will employ the actual measures of these variables taking account of the number of public school teachers in a given state by means of adding an additional independent variable NTEACH. This model specification will be referred to as the absolute model. The two models will be specified as follows:

1. Transformed dependent variable

$$NY_{ij} = \beta_0 + \beta_1 NONAG_{ij} + \beta_2 NAGSQ_{ij} + \beta_3 RTTOWK_{ij} + \beta_4 NNEAMEM_{ij} + \beta_5 NDSTRK_{ij} + \beta_6 MDUTY_{ij} + \beta_7 UNEM_{ij} + \beta_8 LAG2_{ij} + \beta_9 EXPPUP_{ij} + \beta_{10} PCTSMSA_{ij} + \beta_{11} SMSASQ_{ij} + \beta_{12} PCTFEM_{ij};$$

2. Absolute dependent variable

$$Y_{ij} = \beta_0 + \beta_1 NONAG_{ij} + \beta_2 NAGSQ_{ij} + \beta_3 RTTOWK_{ij} + \beta_4 NEAMEM_{ij} + \beta_5 NOSTRK_{ij} + \beta_6 MDUTY_{ij} + \beta_7 UNEM_{ij} + \beta_8 LAG2_{ij} + \beta_9 EXPPUP_{ij} + \beta_{10} PCTSMSA_{ij} + \beta_{11} SMSASQ_{ij} + \beta_{12} PCTFEM_{ij} + \beta_{13} NTEACH_{ij};$$

where:

NY_{ij} represents either $NNSTOP_{ij}$, $NNWKIN_{ij}$, or $NDUR_{ij}$;

Y_{ij} represents either $NSTOP_{ij}$, $NWKIN_{ij}$, or DUR_{ij};

i represents the state or District of Columbia;

j represents the year, 1972 through 1980;

β_0 represents the intercept.

IV. EMPIRICAL RESULTS

This chapter will focus on the empirical results obtained from the two models specified in the previous chapter. Section A will be used to examine the descriptive statistics of the variables considered in the model. Section B will discuss the results obtained from the regression analysis.

A. Descriptive Statistics

This section will examine the descriptive statistics and identify trends regarding the data used in the models specified in the preceding chapter (see Appendix B). An examination of the dependent variable reveals a general trend of increased strike activity from 1972 to 1980, but with a decline in strike activity occurring in 1976 and 1977. Examining the dependent variables in "per teacher" units of measurement leads to the same conclusion. An examination of the individual states reveals that large industrial states, such as California, Illinois, Indiana, Michigan, New Jersey, New York, Ohio, and Pennsylvania, consistently experience the largest fraction of the overall level of strike activity.[3] Of all states examined, only Illinois and Michigan exhibit any trend with regard to an increased level of strike activity. None of the states examined displayed any indication of a decreasing trend in strike activity during the period examined. Most states displayed variation in strike activity throughout the period examined. Hopefully, the regression analysis will explain some of this variation.

The percentage of the nonagricultural workforce which is unionized (NONAG), has been declining, except for the 1979-80 period which exhibits a slight increase. In contrast, the NEAMEM variable used to measure the

[3]Raw data available from author upon request.

degree of public teacher unionization increases until 1978, declining thereafter. This trend may not be truely indicative of teacher unionization, since the NEAMEM measure is subject to error and does not include members of the rival union, AFT. However, it appears as though unionization, in general, has been declining over the period considered, while public teacher unionization has been increasing in relative terms.

Although the majority of legislation concerning public teacher strikes was enacted prior to the period examined in this study, it is apparent that more states are enacting such legislation. In the year 1972, sixty-five percent of the states prohibited strikes by statute. As of 1980, seventy-five percent of the states had "no strike" provisions in effect. On the other hand, it appears as though more states are becoming aware of the problem of public sector strike activity, as evidenced by the increase in the percentage of states enacting mutual duty collective bargaining statutes.

An examination of the economic factors reveals that LAG2, the variable measuring a two period change in real wages for public school teachers, is negative throughout the period examined. This is a significant finding, since it reveals that teacher wages have not kept up with the inflation rate for any of the years examined in this study. On the other hand, expenditures per pupil (EXPPUP) have exhibited an increasing trend in real terms throughout the period. This suggests that, although expenditures for public education have been increasing, the relative share received by public teachers has been declining.

The demographic and teaching environment variables have been relatively constant throughout the period of investigation with a slight increase

in the population living in SMSAs. The number of public teachers increased slightly until 1977, thereafter declining slightly. This may be the result of a population decline in school-age children or a result of more students attending private schools or a combination of both. The percentage of female teachers (PCTFEM) has remained fairly constant throughout the period of investigation, both in aggregate and for individual states. Before discussing the regression results, it may be helpful to point out the large degree of variation exhibited in the majority of variables considered in this study.

B. Regression Results

As stated in the previous chapter, the specified model was run using two formats. One specification was to transform the dependent variables and the NEA members so that they would be measured in "per teacher" units of measurement. The other specification was to measure these variables in absolute terms, adding an additional independent variable NTEACH to account for the differences in each state's number of public school teachers. The R-square for the transformed model specification is consistently lower than the absolute version. This may be due to the fact that the measurement errors in the dependent variables are magnified by dividing these variables by NTEACH, which has a measurement error associated with it as well.

The major focus of this study was to construct a model for the number of work stoppages taking place in the public school teacher segment of the workforce. An examination of the pooled regression results tends to support the use of the independent variables selected as determinants of work stoppages (see Table 4-1). In fact, with the exception of NEAMEM, NNEAMEM,

Table 4-1. Pooled regression results for NSTOP and NNSTOP[a,b]

Variable name	NSTOP	NNSTOP
Intercept	8.9496 (1.792)*	0.0003 (2.871)**
NONAG	-0.4632 (-2.017)**	-0.0000046 (-1.103)
NAGSQ	0.016 (3.45)***	0.00000015 (1.796)*
RTTOWK	-0.0342 (-0.042)	-0.000033 (-2.005)**
NEAMEM	-0.000049 (-2.179)**	N.A.
NNEAMEM	N.A.	-0.000017 (-0.621)
NOSTRK	-1.9936 (-2.941)***	-0.000024 (-1.876)*
MDUTY	0.5836 (0.877)	-0.000023 (-1.822)*
UNEM	0.0597 (0.357)	0.0000068 (2.13)**
LAG2	-0.4241 (-3.682)***	-0.0000064 (-2.914)***
EXPPUP	-0.0018 (-1.31)	-0.00000005 (-1.803)*
PCTSMSA	-0.0283 (-0.618)	-0.0000013 (-1.461)
SMSASQ	0.00043 (1.034)	0.00000002 (2.312)**
PCTFEM	-0.121 (-2.464)**	-0.000003 (-3.134)***
NETACH	0.000104 (5.095)***	N.A.
R-SQUARE	0.4191	0.2077

[a] t-ratios in parentheses.

[b] Two-tailed t-test.

*,**,***Significant at the 10%, 5%, and 1% levels, respectively.

and MDUTY in the absolute format, all independent variables have the expected signs in the regressions on the number of stoppages. Although both specifications are fairly consistent as to sign, the transformed (NNSTOP) specification seems to result in higher significance levels for the independent variables than does the absolute (NSTOP) specification. That is, the independent variables seem to exhibit greater precision of estimation when using the specification which transforms the relevant variables into "per teacher" units of measurement. It was thought that the NONAG coefficient would be negative and the NAGSQ coefficient positive with this configuration leading to a convex quadratic function. All NONAG and NAGSQ coefficients displayed these signs in the pooled specification for the number of stoppages with 3 of 4 being significant. A F-test was performed on the slope of the NONAG and NAGSQ measures in addition to testing the significance of jointly using these measures in the model (see Appendix C). The F-test revealed that the slope and joint inclusion of both NONAG and NAGSQ was significant in the absolute (NSTOP) specification only.

The coefficient on RTTOWK was negative as hypothesized. However, only the transformed model was found to be significant. This is probably due to the effect of the transformation which accounts for the population differences, since right-to-work laws are in effect in states with relatively small populations.

A rather puzzling finding was the consistently negative coefficient on both the NEAMEM and NNEAMEM measures with the NEAMEM being significant. It was thought that NEA membership was positively related to the number

of stoppages, but the findings of this study do not strongly support this hypothesis.[4]

The legal variables, NOSTRK and MDUTY, were surprisingly strong determinants of the number of stoppages. The NOSTRK variable was negative as hypothesized and significant for both the transformed and absolute models. The MDUTY variable exhibited mixed results as the coefficient was negative and significant in the transformed specification only. Although the sign on MDUTY was positive in the absolute model, the significance was rather weak and, therefore, the alternative hypothesis that MDUTY leads to increased strike activity is rather weak and should probably be rejected. Prior studies (3) found no significant relationship between the legal determinants and the number of stoppages. This was thought to be a result of the laws being recently enacted and not enough time elapsing for the workforce to adjust to the changing legal environment (23).

When considering the economic variables, it was hypothesized that UNEM and EXPPUP could have either positive or negative coefficients depending on which of the alternative hypotheses one chooses. The pooled coefficients on UNEM are both positive with the transformed specification significant. This suggests that higher levels of unemployment seem to be associated with more industrialized areas which typically experience more work stoppages. The coefficients were negative for the EXPPUP measures,

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[4] There were numerous measurement problems associated with the NEA measures. In addition, the NEAMEM variable was used as a proxy for public school teacher unionization and any membership movement to the rival union, AFT, is not accounted for in this study.

with the transformed specification being significant. This result leads one to weakly conclude that states which fund their public school systems at higher levels experience fewer work stoppages. The LAG2 variable was negative and significant, confirming previous studies' results which concluded that real wages are major determinants of work stoppages.

The demographic variables were consistent in sign as was hypothesized. The quadratic SMSASQ was significant for the transformed model only. The slope and joint inclusion F-tests regarding the PCTSMSA and SMSASQ measure were not significant (see Appendix C). The remaining demographic variables, PCTFEM and NTEACH, displayed the expected sign coefficient and were found to be highly significant as determinants of the number of work stoppages.

The remaining dependent variables regarding the number of workers involved and work-days idle will likewise be analyzed in a pooled specification.[5] The independent variables used in this model were less successful as determinants of the number of workers involved and the number of work-days idle. The number of workers involved in a work stoppage is a function of the size of the work unit involved in the stoppage. Although variables, such as PCTSMSA, attempt to differentiate between states with large and small urban populations, it does not take into account the stoppages which take place in urban versus rural areas. Hence, it is believed that the lack of success with regard to the NWKIN and NNWKIN dependent variables is due to the large degree of population differences among a given state's school districts of which this cross-section has no adequate specification to measure.

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[5]Yearly regression results are available from the author upon request.

The work-days idle (DUR and NDUR) regressions were not as successful as were the number of stoppages regressions. This is, in part, due to the fact that work-days idle are a function of the number of workers involved. As such, any measurement problems present in the number of workers involved measure is magnified when considering the measurement of work-days idle.

Table 4-2 presents the results of the pooled regressions regarding NWKIN and NNWKIN. The absolute specification exhibited the hypothesized sign coefficients on all of the independent variables. However, only the quadratic term (NAGSQ), LAG2, and NTEACH, were significant. The legal variables, MDUTY and NOSTRK, were of the hypothesized sign, but were not found to be significant. It appears as though these laws have little effect on the number of workers involved in a work stoppage.

The transformed model (NNWKIN) is not as consistent as far as the sign coefficients are concerned. In addition, none of the independent variables were found to be significant in the transformed specification. The coefficient on NNEAMEM was negative, which is again opposite to the hypothesized sign. The coefficients on MDUTY and PCTFEM were both positive, which is opposite to the hypothesized signs regarding these variables. As was the case with the NNSTOP, it appears as though the transformation procedure which transforms teacher-based variables into "per teacher" measures weakens the model's explanatory power.

The F-tests measuring the significance of the slope and joint inclusion of the NONAG and NAGSQ, PCTSMSA and SMSASQ terms displayed mixed results. The F-tests were significant in the absolute specification for the

Table 4-2. Pooled regression results for NWKIN and NNWKIN[a,b]

Variable name	NWKIN	NNWKIN
Intercept	2200.2 (0.598)	-0.0185 (-0.21)
NONAG	-197.706 (-1.169)	-0.0014 (-0.401)
NAGSQ	6.6788 (1.957)*	0.000061 (0.86)
RTTOWK	-126.728 (-0.21)	-0.0168 (-1.195)
NEAMEM	0.0022 (0.135)	N.A.
NNEAMEM	N.A.	-0.0086 (-0.362)
NOSTRK	-521.715 (-1.045)	-0.0156 (-1.406)
MDUTY	-9.367 (-0.019)	0.0056 (0.518)
UNEM	121.985 (0.99)	0.0034 (1.223)
LAG2	-215.66 (-2.542)**	-0.0018 (-0.948)
EXPPUP	-0.2698 (-0.268)	-0.000012 (-0.55)
PCTSMSA	-21.829 (-0.647)	-0.0003 (-0.401)
SMSASQ	0.2389 (0.772)	0.000008 (1.172)
PCTFEM	-44.2172 (-1.223)	0.00046 (0.535)
NTEACH	0.0327 (2.185)**	N.A.
R-SQUARE	0.2479	0.0946

[a]T-ratios in parentheses.

[b]Two-tailed T-test.

*,**Significant at the 10% and 5% levels, respectively.

NONAG measures and in the transformed model for the SMSA measures (see Appendix C).

Table 4-3 presents results from the pooled model concerning the work-days idle (DUR and NDUR) dependent measures. Two variables, the NEA membership and mutual duty (MDUTY) measures were opposite of the hypothesized sign in both the absolute and transformed model specification. The quadratic term (NAGSQ) was significant in the absolute specification as was the NOSTRK measure. The coefficient on the UNEM variable was negative, but not significant. This result is opposite to the coefficient signs on UNEM for the other dependent measures. This weakly suggests that the alternative hypothesis may apply in this case. That is, a higher unemployment rate leads to a reduction in work-days idle.

The PCTFEM coefficient displayed a positive sign for the NDUR model, but had the hypothesized negative sign for the absolute model specification. The LAG2 measure was of the hypothesized negative sign and significant for both model specifications. In addition, the NTEACH variable was positive and significant as a determinant of DUR.

The F-test regarding the inclusion of both NONAG and NAGSQ was significant in both the transformed (NDUR) and absolute (DUR) models. The slope test was significant for NONAG only in the absolute (DUR) model. The slope test and joint inclusion test for the SMSA measures were significant only in the transformed (NDUR) specification (see Appendix C).

The overall results of this model may now be summarized. The regression models employing the absolute specification were, in general, more successful than were the transformed models. The model regarding the number

Table 4-3. Pooled regression results for DUR and NDUR[a,b]

Variable name	DUR	NDUR
Intercept	34671.87 (0.815)	-0.1738 (-0.166)
NONAG	-2407.68 (-1.231)	-0.0157 (-0.37)
NAGSQ	82.2767 (2.085)**	0.00074 (0.882)
RTTOWK	-1285.58 (-0.185)	-0.1376 (-0.826)
NEAMEM	-0.0826 (-0.436)	N.A.
NNEAMEM	N.A.	-0.4441 (-1.57)
NOSTRK	-12020.4 (-2.083)**	-0.1273 (-0.965)
MDUTY	3551.024 (0.627)	0.0883 (0.683)
UNEM	-370.1508 (-0.26)	-0.0022 (-0.066)
LAG2	-2819.91 (-2.875)***	-0.0373 (-1.654)*
EXPPUP	-8.4265 (-0.723)	-0.000024 (-0.091)
PCTSMSA	40.058 (0.103)	-0.0054 (-0.604)
SMSASQ	0.4478 (0.125)	0.0001 (1.229)
PCTFEM	-505.5964 (-1.209)	0.0077 (0.755)
NTEACH	0.3944 (2.277)**	N.A.
R-SQUARE	0.2097	0.0789

[a]T-ratios in parentheses.

[b]Two-tailed t-test.

*,**,***Significant at the 10%, 5%, and 1% levels, respectively.

of stoppages was fairly successful as the majority of the independent variables had the hypothesized sign, many of which were significant. The models relating to the number of workers involved and work-days idle were not as successful. This is probably a result of the large degree of in-state variation which is present in many of the variables used in this study. The next chapter will present two alternative models which, hopefully, will provide further insight regarding public school teacher strike activity.

V. ALTERNATIVE MODELS

This chapter will be used to formulate and present two alternative models regarding public school teacher strike activity. Section A will present a model which incorporates the individual states as additional dummy variables to further account for the variation of strike activity. Section B will examine the possibility of a simultaneous equation bias and develop a two-stage least squares model which addresses this possibility.

A. State Dummy Model

The previous model results indicated that a large degree of variation in strike activity was not accounted for. Although the independent variables specified were fairly successful as determinants of strike activity, there remains a degree of variability that cannot be captured by the specified determinants. That is, the specified determinants used cannot completely control for differences, such as teacher militancy, tastes toward unionization or strike activity, and the industrial or occupation mix of workers in a given state. Therefore, it is thought that, by including individual state dummy variables as additional determinants, some of the variability that was not accounted for in the initial model may be captured by the individual "state effects."

The basic model used in the previous chapter was modified by including a dummy variable for each state and the District of Columbia. One state must be omitted as a dummy variable to prevent the model from becoming singular. The state chosen for omission was Alaska. Alaska was omitted since it was unique in its legal environment when compared to the remaining states. The state of Alaska is the only state with no laws

regarding public strikes and no right-to-work legislation. When the state dummy variables are included, the model can only be examined in a pooled specification because there are not sufficient degrees of freedom when using only yearly observations.

The regressions including the state dummy variables were run using both the transformed and absolute model specification for all three dependent variables in a pooled analysis (see Table 5-1). As was the case with the previous model, the NSTOP and NNSTOP dependent variables exhibited the best results and will, therefore, be the major focus of the discussion which follows.

The coefficients on the NAGSQ, SMSASQ, NEA measures, PCTFEM, and NTEACH change sign when adding the state dummy variables to the number of stoppages model. This may be a result of the state dummies capturing the population differences among the states that these variables were originally designed to capture. A more puzzling result is the NOSTRK coefficient which changes sign becoming positive and significant. This may be due to a mis-specification concerning the NOSTRK determinant. That is, there may be a simultaneous equation bias associated with the NOSTRK variable. This possibility will be examined later in the chapter.

The F-test performed to test for the joint inclusion of NONAG and NAGSQ, as well as PCTSMSA and SMSASQ, displayed no significance in any of the regressions performed. An additional F-test on the slopes of the NONAG and SMSA measures was also found to be insignificant (see Appendix D).

Of the 100 state dummies used in both the transformed and absolute model specifications regarding the number of stoppages, 68 had negative

Table 5-1. Pooled data including state dummy variables[a,b]

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
Intercept	0.0004 (1.499)	0.5292 (2.012)**	3.2785 (1.018)	2.0729 (0.188)	9596.81 (0.867)	124068.6 (0.976)
NONAG	-0.000007 (-0.62)	-0.019 (-1.796)*	-0.113 (-0.874)	-0.0749 (-0.162)	82.9066 (0.179)	247.72 (0.047)
NAGSQ	0.00000003 (0.175)	0.00033 (1.651)*	0.002 (0.823)	-0.0022 (-0.252)	-3.0445 (-0.352)	-26.2937 (-0.265)
RTTOWK	-0.000006 (-0.096)	0.0214 (0.331)	0.1608 (0.203)	-0.559 (-0.199)	-895.33 (-0.317)	-10331.9 (-0.319)
NNEAMEM	0.00003 (0.51)	-0.073 (-1.203)	-0.653 (-0.883)	N.A.	N.A.	N.A.
NEAMEM	N.A.	N.A.	N.A.	0.00003 (0.605)	0.106 (2.011)**	1.0965 (1.81)*
NOSTRK	0.00007 (2.655)***	0.0063 (0.238)	0.1364 (0.422)	3.8831 (3.419)***	262.098 (0.23)	6849.91 (0.523)
MDUTY	-0.00004 (-1.389)	-0.0072 (-0.235)	-0.2616 (-0.702)	-2.2691 (-1.73)*	-1285.13 (-0.976)	-16099 (-1.064)
UNEM	0.000004 (1.239)	0.0048 (1.343)	0.0322 (0.739)	0.0749 (0.478)	141.034 (0.897)	204.584 (0.113)
LAG2	-0.000008 (-3.503)***	-0.0042 (-1.878)*	-0.434 (-1.576)	-0.3887 (-3.997)***	-210.002 (-2.152)**	-2466.43 (-2.199)**

[a]T-ratios in parentheses.

[b]Two-tailed t-test.

*,**,***Significant at the 10%, 5%, and 1% levels, respectively.

Table 5-1. *Continued*

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
EXPPUP	-0.0000001 (-2.842)***	-0.0001 (-2.232)**	-0.0004 (-0.73)	-0.0025 (-1.162)	-4.3805 (-2.054)**	-36.5026 (-1.49)
PCTSMSA	0.000002 (0.438)	0.0003 (0.063)	-0.0096 (-0.184)	0.0348 (0.189)	41.5965 (0.225)	315.707 (0.149)
SMSASQ	-0.00000005 (-0.935)	-0.000002 (-0.03)	0.0002 (0.298)	-0.0023 (-1.0)	-0.9884 (-0.433)	-7.9198 (-0.302)
PCTFEM	0.0000008 (0.327)	-0.0003 (-0.116)	-0.0077 (-0.273)	0.1452 (1.447)	-62.4956 (-0.62)	-867.167 (-0.749)
NTEACH	N.A.	N.A.	N.A.	-0.00005 (-0.72)	0.3136 (4.47)***	2.2704 (2.816)***
ALB	-0.0004 (-2.727)***	-0.2137 (-1.653)*	-1.2414 (-0.785)	-8.9057 (-1.41)	-17396.8 (-2.744)***	-148817 (-2.043)**
ARZ	-0.00016 (-1.097)	-0.204 (-1.391)	-1.4905 (-0.831)	1.1223 (0.174)	-9639.31 (-1.488)	-87628.2 (-1.178)
ARK	-0.00044 (-3.371)***	-0.2498 (-1.95)*	-1.3034 (-0.831)	-13.6727 (-2.411)**	-12686.2 (-2.229)**	-113168 (-1.73)*
CAL	0.000009 (0.041)	-0.1298 (-0.62)	-1.2765 (-0.498)	22.8502 (1.181)	-72545.5 (-3.735)***	-574294 (-2.573)**
COL	-0.00014 (-0.954)	-0.1593 (-1.06)	-1.3074 (-0.711)	1.2237 (0.178)	-11767.9 (-1.708)*	-110433 (-1.395)
CON	0.00002 (0.108)	-0.104 (-0.516)	-1.1552 (-0.468)	9.1366 (1.0)	-10512.2 (-1.147)	-94156.2 (-0.894)
DEL	-0.0001 (-0.974)	0.0136 (0.134)	-0.1337 (-0.108)	-1.2594 (-0.285)	-1880.09 (-0.425)	-27706.1 (-0.544)
DC	0.0001 (0.375)	-0.0511 (-0.197)	0.0716 (0.023)	7.4368 (0.662)	3946.75 (0.35)	35607.98 (0.275)

Table 5-1. *Continued*

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
FLA	-0.00018 (-0.954)	-0.2759 (-1.436)	-2.03 (-0.863)	2.2269 (0.236)	-24383.3 (-2.577)**	-199035 (-1.831)*
GA	-0.00039 (-2.844)***	-0.2628 (-1.956)*	-1.5198 (-0.924)	-10.2604 (-1.506)	-22012.7 (-3.218)***	-185199 (-2.356)**
HAW	-0.000003 (-0.02)	0.0529 (0.338)	0.3996 (0.209)	5.8625 (0.867)	711.777 (0.105)	10867.94 (0.139)
IDH	-0.0002 (-1.741)*	-0.167 (-1.485)	-0.5283 (-0.384)	-7.1292 (-1.445)	-7634.86 (-1.541)	-71962.2 (-1.264)
ILL	0.00007 (0.462)	-0.0591 (-0.388)	-0.7086 (-0.38)	24.1711 (2.218)**	-30015.6 (-2.744)***	-236049 (1.878)*
IND	-0.00009 (-0.872)	-0.1192 (-1.154)	-0.609 (-0.482)	5.0507 (0.788)	-19458.2 (-3.025)***	-155151 (-2.099)**
IA	-0.0003 (-2.965)***	-0.1551 (-1.497)	-0.6355 (-0.501)	-7.8066 (-1.477)	-15940.1 (-3.004)***	-139192 (-2.284)**
KAN	-0.0003 (-2.851)***	-0.213 (-1.843)*	-0.9677 (-0.684)	-8.4744 (-1.603)	-12156.9 (-2.291)**	-108881 (-1.786)*
KTY	-0.0004 (-3.75)***	-0.14 (-1.43)	-0.5358 (-0.447)	-10.8884 (-2.063)**	-16595.2 (-3.133)***	-143129 (-2.352)**
LA	-0.0002 (-1.966)**	-0.2473 (-1.994)**	-1.5392 (-1.014)	-3.3789 (-0.593)	-16269.8 (-2.844)***	-131466 (-2.0)**
MNE	-0.0004 (-3.709)***	-0.183 (-1.898)*	-0.6985 (-0.592)	-10.6834 (-2.467)**	-9548.57 (-2.197)**	-88148.3 (-1.765)*
MD	-0.00009 (-0.509)	-0.104 *-0.62)	-0.7446 *-0.363)	3.7277 (0.467)	-13907.9 (-1.735)*	-111344 (-1.209)
MAS	0.00002 (0.094)	-0.1107 (-0.478)	-1.2768 (-0.451)	11.1126 (0.973)	-22947.7 (-2.002)**	-188422 (-1.431)

Table 5-1. *Continued*

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
MIC	0.00029 (1.876)*	-0.0189 (-0.125)	0.2749 (0.148)	35.2209 (3.331)***	-25056 (-2.361)**	-162376 (-1.332)
MIN	-0.0001 (-1.472)	-0.1095 (-1.233)	-0.5996 (-0.551)	1.8292 (0.329)	-18613.9 (-3.333)***	-158326 (-2.467)**
MIS	-0.0004 (-2.796)***	-0.2987 (-2.078)**	-1.4588 (-0.855)	-11.5386 (-1.898)*	-13310.4 (-2.182)**	-113432 (-1.618)
MO	-0.0002 (-2.019)**	-0.1745 (-1.598)	-0.9072 (-0.679)	-3.0313 (-0.525)	-17880.9 (-3.084)***	-130167 (-1.956)*
MON	-0.0002 (-2.487)**	-0.1027 (-1.299)	-0.2047 (-0.212)	-5.5598 (-1.575)	-6139.86 (-1.732)*	-55843.1 (-1.371)
NEB	-0.0004 (-3.194)***	-0.1916 (-1.636)	-1.0216 (-0.713)	-10.9241 (-2.087)**	-10586.8 (-2.015)**	-103051 (-1.707)*
NEV	-0.0001 (-0.764)	-0.1696 (-1.04)	-1.2957 (-0.658)	2.2024 (0.316)	-1003.48 (-0.143)	-11285.2 (-0.14)
NH	-0.0003 (-2.693)***	-0.2051 (-2.072)**	-0.8719 (-0.72)	-7.527 (-1.761)*	-6900.16 (-1.609)	-69636.6 (-1.413)
NJ	0.00008 (0.367)	-0.0641 (-0.314)	-0.9418 (-0.377)	15.3346 (1.352)	-27485.9 (-2.414)**	-235408 (-1.799)*
NM	-0.0004 (-3.873)***	-0.2197 (-2.137)**	-1.1295 (-0.898)	-12.3933 (-2.755)***	-9717.62 (-2.152)**	-93649.3 (-1.805)*
NY	0.00007 (0.404)	-0.0293 (-0.16)	-0.6017 (-0.268)	18.2099 (0.939)	-72132 (-3.193)***	-151247 (-2.304)**
NC	-0.0004 (-2.59)***	-0.3225 (-2.15)**	-1.6309 (-0.889)	-9.4984 (-1.232)	-24677.9 (-3.19)***	-207836 (-2.338)**

Table 5-1. *Continued*

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
ND	-0.0004 (-2.983)***	-0.2211 (-1.772)*	-0.9983 (-0.654)	-10.6561 (-1.976)**	-6167.89 (-1.139)	-63456.3 (-1.02)
OH	-0.00004 (-0.272)	-0.1194 (-0.806)	-0.9073 (-0.5)	15.3129 (1.373)	-37325.6 (-3.335)***	-288057 (-2.24)**
OK	-0.0003 (-3.05)***	-0.2185 (-2.043)**	-1.0304 (-0.787)	-7.6048 (-1.457)	-14400.2 (-2.749)***	-126919 (-2.109)**
ORG	-0.0001 (-1.28)	-0.1039 (-1.359)	-0.4654 (-0.497)	2.3848 (0.607)	-10505.1 (02.662)***	-88507.7 (-1.952)*
PEN	0.0003 (1.834)*	-0.0421 (-0.288)	0.3789 (0.212)	40.8122 (3.424)***	-33133.4 (-2.77)***	-184668 (-1.344)
RI	0.0004 (1.815)*	0.0004 (0.002)	-0.4842 (-0.202)	8.7912 (1.033)	-1365.14 (-0.16)	-20808.6 (-0.212)
SC	-0.0005 (-2.888)***	-0.3425 (-2.21)**	-1.9061 (-1.005)	-13.471 (-1.979)**	-14095.9 (-2.064)**	-125531 (-1.599)
SD	-0.0004 (-2.864)***	-0.2629 (-1.868)*	-1.2056 (-0.7)	-12.2681 (-2.019)**	-6283.58 (-1.03)	-65176 (-0.93)
TEN	-0.0003 (-2.5)**	-0.1922 (-1.513)	-1.0426 (-0.671)	-6.9603 (-1.074)	-18427.3 (-2.832)***	-159074 (-2.128)**
TEX	-0.0003 (-1.522)	-0.2649 (-1.536)	-1.9378 (-0.918)	-0.8462 (-0.061)	-56420.5 (-4.072)***	-461547 (-2.899)***
UT	-0.0002 (-1.404)	-0.189 (-1.147)	-1.5692 (-0.778)	-1.4467 (-0.202)	-6427.93 (-0.893)	-72413.1 (-0.875)
VER	-0.0002 (-1.471)	-0.1696 (-1.223)	-0.7568 (-0.446)	-7.3804 (-1.225)	-5586.74 (-0.924)	-54146.9 (-0.765)

Table 5-1. *Continued*

Variable name	Transformed			Absolute		
	NNSTOP	NNWKIN	NDUR	NSTOP	NWKIN	DUR
VA	-0.0003 (-2.333)**	-0.2435 (-1.75)*	-1.5492 (-0.909)	-7.2692 (-0.99)	-23741.2 (-3.221)***	-201378 (-2.378)**
WA	-0.00005 (-0.412)	-0.087 (-0.785)	-0.6106 (-0.45)	5.0343 (0.859)	-13541.3 (-2.303)**	-115730 (-1.713)*
WVA	-0.0003 (-3.163)***	-0.1795 (-1.863)*	-0.96 (-0.814)	-9.2009 (-1.969)**	-11040.3 (-2.354)**	-93516.2 (-1.735)*
WIS	-0.0001 (-1.189)	-0.0645 (-0.783)	0.2654 (0.263)	3.4009 (0.588)	-18156.9 (-3.129)***	-127764 (-1.916)*
WYO	-0.0002 (-1.652)*	-0.146 (-0.974)	-0.8682 (-0.473)	-8.3746 (-1.285)	-4116.54 (-0.629)	-47924.6 (-0.638)
R-square	0.4841	0.2118	0.1481	0.7405	0.3763	0.3527

coefficients of which 34 were significant. Of the 32 cases in which the coefficient was positive, 7 of these were significant. Only two states, Michigan and Pennsylvania, were significant and positive with regard to both NSTOP and NNSTOP. The states which displayed a significantly negative coefficient in both the transformed and absolute model specifications were: Arkansas, Kentucky, Maine, Mississippi, Nebraska, New Hampshire, New Mexico, North Dakota, South Carolina, South Dakota, and West Virginia.

Of the 100 state dummies used in both the transformed and absolute specifications regarding the number of workers involved, 96 had negative coefficients of which 52 were significant. Of the 4 cases in which the coefficients were positive, none were significant. The states displaying a significantly negative coefficient in both the transformed and absolute specifications were: Alabama, Arkansas, Georgia, Kansas, Louisiana, Maine, Mississippi, New Mexico, North Carolina, Oklahoma, South Caorlina, Virginia, and West Virginia.

The work-days idle regressions (NDUR and DUR) were not as successful when using the state dummy variables. Of 100 cases, 93 had negative coefficients, of which 28 were significant. However, none of the states were significant in either a negative or positive correlation across both the transformed and absolute model specifications.

There were 28 states which were consistently negative in sign across all 6 dependent variables. Of these 28 states, none were found to be significant across all dependent variables used in this study. No states were found to display a consistently positive sign coefficient across all dependent measures.

The rationale for the inclusion of the state dummy variables was to determine if there were any "state effects" which were not adequately captured by the original model. A F-test performed to determine the significance of the inclusion of the 50 state dummy variables displayed significance for the inclusion of the state dummies for the NSTOP and NNSTOP regression models.[6]

The explanatory power of the model seemed to improve across all dependent measures when the state dummy variables were added. However, when examining the significant state dummy variables with regard to the number of stoppages, no clear reason is apparent for their significance. A positive coefficient was displayed for both Michigan and Pennsylvania, both of which have large populations and strong union movements. However, states such as Ohio and Illinois also have strong union movements and were not found to be consistently significant. The states which display a consistently negative and significant coefficient are equally puzzling. About the only common thread among them is that they all have a relatively small population. However, states such as Wyoming also have small populations and are not statistically significant. In conclusion, one can only state that these significant state dummy variables are capturing some determinant of the number of stoppages which were not adequately captured by the original independent variables.

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[6]A F-test was not performed regarding the significance of the state dummy variables in the NWKIN, NNWKIN, DUR, and NDUR regressions.

B. Simultaneous Equation Model

As was stated earlier, the sign change on the NOSTRK measure when regressed against the number of stoppages (NSTOP and NNSTOP) may be an indication of a simultaneous equation bias. This section will be used to formulate an alternative two-stage least squares (TSLS) model which will examine the possibility of a simultaneous equation bias.

The basic question to be addressed is: does the existence of a "no strike" law lead to a reduction in the number of stoppages or does a large number of stoppages lead to the passage of a no strike law? A reduced model using two-stage least squares was specified in an attempt to answer this question. An additional independent variable, "DMSOUTH," was added to the model as a dummy variable. This variable will be used to identify states defined by the Bureau of the Census (26) as being southern as a regional specification. This DMSOUTH variable was added to the model as a determinant of no strike legislation (15).

The following two-stage least squares (TSLS) model was specified as follows:

$$NOSTRK_{ij} = \beta_0 + \beta_1 \widehat{NSTOP}_{ij} + \beta_2 NONAG_{ij} + \beta_3 NAGSQ_{ij} + \beta_4 RTTOWK_{ij} + \beta_5 DMSOUTH_{ij};$$

$$NSTOP_{ij} = \beta_0 + \beta_1 \widehat{NOSTRK}_{ij} + \beta_2 NEAMEM_{ij} + \beta_3 LAG2_{ij} + \beta_4 UNEM_{ij} + \beta_5 PCTFEM_{ij} + \beta_6 NTEACH_{ij} + \sum_{k=7}^{56} \beta_k DUMSTATE_{jk};$$

where:

β_0 represents the intercept;

i represents the state or District of Columbia;

j represents the year;

k represents the 50 state and district dummy variables.

Note: The transformed specification of the above model eliminates the NTEACH variable and uses NNSTOP and NNEAMEM measures in place of the NSTOP and NEAMEM variables.

Since the TSLS model was specified using a reduced set of independent variables, a reduced model must also be specified using ordinary least squares (OLS). This reduced OLS model is necessary in order to compare the results to determine if there is evidence of a simultaneous equation bias in the NOSTRK measure. The reduced form OLS model was specified as follows:

$$NSTOP_{ij} = \beta_0 + \beta_1 NOSTRK_{ij} + \beta_2 NEAMEM_{ij} + \beta_3 LAG2_{ij} + \beta_4 UNEM_{ij}$$
$$+ \beta_5 PCTFEM_{ij} + \beta_6 NONAG_{ij} + \beta_7 NAGSQ_{ij} + \beta_8 RTTOWK_{ij}$$
$$+ \beta_9 DMSOUTH_{ij} + \beta_{10} NTEACH_{ij} +$$
$$+ \sum_{k=11}^{60} \beta_k DUMSTATE_{jk}$$

where:

β_0 represents the intercept;

i represents the state or District of Columbia;

j represents the year;

k represents the 50 state and district dummy variables.

Note: The transformed model specification omits NTEACH and uses NNSTOP and NNEAMEM instead of NSTOP and NEAMEM.

The results of both the OLS and TSLS regressions are presented in Table 5-2. The OLS coefficient on the variable NOSTRK is positive and significant when using the fifty state dummy variables in the regression for the number of stoppages. When the model is specified without the state dummy variables, the NOSTRK coefficient is negative and significant which is consistent with the hypothesis. When using the same variables in the TSLS model, the only sign change taking place was the NOSTRK coefficient which became negative in the transformed (NNSTOP) model specification. The NOSTRK coefficient remained positive in the absolute (NSTOP) model although the coefficient significance is drastically reduced. This finding tends to support the presence of a simultaneous equation bias with respect to the variable NOSTRK.

Table 5-2. OLS vs. TSLS: Pooled data with state dummy variables[a,b,c]

Variable name	OLS NSTOP	TSLS NSTOP	OLS NNSTOP	TSLS NNSTOP
Intercept	-10.5661 (-1.174)	-13.2529 (-1.707)*	-0.00004 (-0.158)	-0.00007 (-0.346)
NOSTRK	2.8182 (2.698)***	1.086 (0.152)	0.00005 (1.973)**	-0.00005 (-0.24)
NEAMEM	0.00002 (0.389)	0.00004 (0.681)	N.A.	N.A.
NNEAMEM	N.A.	N.A.	0.00004 (0.641)	0.00007 (0.917)
UNEM	0.1148 (0.734)	0.1806 (0.643)	0.000005 (1.509)	0.000005 (0.604)
PCTFEM	0.1423 (1.428)	0.1526 (1.522)	0.0000003 (0.145)	0.0000007 (0.281)
NONAG	0.0911 (0.199)	N.A.	0.0000002 (0.022)	N.A.
NAGSQ	-0.0041 (-0.478)	N.A.	-0.00000004 (-0.192)	N.A.
RTTOWK	-0.2537 (-0.09)	N.A.	0.0000005 (0.008)	N.A.
DMSOUTH	N.A.	N.A.	N.A.	N.A.
NTEACH	-0.00008 (-1.169)	-0.00006 (-0.94)	N.A.	N.A.
R-SQUARE	0.7355	0.73	0.4675	0.4429

[a]T-ratios in parentheses.

[b]Two-tailed t-test.

[c]Coefficients and t-ratios regarding the individual state dummy variables are available from the author upon request.

*,**,***Significant at the 10%, 5%, and 1% levels, respectively.

VI. SUMMARY, QUALIFICATIONS, AND CONCLUSIONS

A. Summary

Chapter I of this thesis presented a brief description of the growing problem of public school teacher strike activity. The chapter included a discussion of possible reasons why this segment of the workforce experiences more strike activity than any other public sector employee group.

Chapter 2 examined the theory of strikes in general, with special emphasis given to Hicks' (8) theory of "faulty negotiation" and an expanded theoretical version proposed by Ashenfelter and Johnson (1).

Previous empirical studies concerning the determinants of strike activity, both in general and specifically related to the public sector, were examined. The general consensus of opinion regarding strike activity was that economic factors, such as the unemployment rate, the rate of inflation, and, in particular, the worker's real wages, were found to be most significant as determinants of strike activity. Other reasons cited for strike activity were the degree of unionization and occupational mix of the workforce. The individual state's legal environment was also examined in many of the previous studies. However, the results concerning legal determinants and their effect on strike activity, both in general and public sector employment groups, were found to be inconsistent and, therefore, not of much use in providing information for future public legislation.

Chapter 3 was used to develop a model of strike activity specifically focusing upon the public school teacher segment of the workforce. As most of the previous investigations concerning public sector strike activity were completed during the early 1970s, a later period of examination was

chosen for the time frame of this study. The majority of the legal statutes regarding public sector strike activity were enacted during the late 1960s to early 1970s, a period which corresponds to the majority of research concerning public sector strike activity. Therefore, a major focus of this study was to examine whether these previously enacted legal statutes had the effect that they were desired to have -- namely, to decrease the amount of public sector strike activity.

This study did not limit the examination of strike activity to only legal or economic variables as determinants. The nature of today's workforce is too complex to capture the determination of strike activity by only considering a few variables. Therefore, this study incorporated a broad spectrum of determinants. Factors thought to influence public teacher strike activity were broadly categorized by the following groups: unionization, economic and legal environments, demographic characteristics, and teacher specific working environments. On the basis of economic theory and results from previous studies, a regression model was developed regarding public school teacher strike activity. An OLS model was developed to examine the number of stoppages, the number of workers involved, and the number of work-days idle caused by the stoppage.

The results of the basic OLS model were presented in Chapter 4. Two alternative models were analyzed: a transformed model which transforms the dependent variables and NEA members into "per public teacher" units and an absolute model which accounted for teacher population differences by adding an additional independent variable, NTEACH.

The regressions on the number of stoppages exhibited the best results. With the exception of the NEA membership variables and MDUTY in the

absolute specification, all other independent variables displayed the hypothesized sign. The quadratic term (NAGSQ), NOSTRK, LAG2, and PCTFEM were significant in both the transformed and absolute model specifications.

The regressions regarding the other dependent variables NWKIN, NNWKIN, DUR, and NDUR were not as successful. Fewer independent variables were consistent in sign across both the transformed and absolute model specifications. In fact, none of the independent measures were consistently significant in the regressions on the number of workers involved and only LAG2 was consistently significant when regressed on work-days idle. The absolute model specification displayed the best results as NAGSQ, LAG2, and NTEACH were found to be consistently significant across all three dependent measures. The transformed model specification displayed no consistent significance across the three dependent measures analyzed.

Although the variables selected as determinants of the number of stoppages were fairly successful, there remained a fairly large degree of variability not accounted for by the proposed model. Chapter 5 presented two alternative models. A state dummy model was formulated to include a state dummy variable for each state with the exception of Alaska. This procedure was used so that some of the variability not accounted for might be captured by the individual state effects. Results of this model tend to confirm that these state effects thought to capture the variability in tastes, militancy, and occupational mix not captured by the previously defined model were significant.

When adding the state dummy variables to the model, several coefficients changed sign. The MDUTY measure is consistently negative in sign across all dependent measures as was hypothesized, when using the state

dummy model. Many of the sign changes on the SMSA measures, PCTFEM, and NTEACH could be attributed to the individual state effects which captured some of the effect these variables were originally designed to capture. One variable which displayed a drastic sign change and was not thought to be a function of the individual state effects was the NOSTRK measure which changed both sign and significance when regressed against NSTOP and NNSTOP.

The sign change on NOSTRK was thought to be an indication of a simultaneous equation bias concerning this measure. That is, it may be that states which experience a large number of strikes enact a no strike law rather than a no strike law reducing the number of strikes. An alternative model was formulated using a TSLS procedure. When the simultaneous equation bias was taken into account the sign on the transformed NOSTRK measure changed. The sign on the absolute NOSTRK measure remained positive, although the significance was drastically reduced. These changes regarding the NOSTRK measure may be taken as an indication of the presence of a simultaneous equation bias.

B. Qualifications

Unfortunately, because of data collection problems, this study is limited to a nine-year period. This relatively short period of investigation limits examining the cyclical variation involving the economic variables. In addition, any trend activity among the variables used in this study is limited because of the relatively short period of examination. A longer time series would have been desirable in order to better capture the cyclical variation in the data and to identify any possible trend activity, especially with regard to the growth of public sector unionization.

Care must be exercised when interpreting the results of this study since problems were experienced in developing a full data set for the period examined. Many of the data sources used did not contain a complete set covering the years of this study which resulted in interpolation for the missing data. The actual data for these missing years are not known; however, it seems unlikely that the missing data are perfectly linearly related to the data used as an estimate. The NONAG measure was only available for even years. The measure for PCTFEM, a variable that displayed a high degree of success in the models examined, was based on data for three years, with the remaining six years being linearly interpolated. The EXPPUP and LAG2 measures were not available for 1980, so that this year was linearly extrapolated based on prior data.

A more serious data problem involves the SMSA measure. The number of SMSAs changed throughout the period. The SMSA measure used was based on the percentage of a state's population residing in SMSAs. Some states examined showed much variability in this percentage, even though the basic population characteristics of the state did not change. That is, a county with a population of 49,990 is not considered a SMSA, but once that same county reaches a population of 50,000 it is defined as a SMSA. For largely populated states, this makes little difference, but for states with small populations, this fact may significantly affect the accuracy of this measurement. The number of SMSAs changed from 281 in 1978 to 318 in 1979. Rather than bias results based on using the true data, it was decided to repeat the 1978 measures for the years 1979 and 1980 in order to obtain a more consistent data set.

The NEAMEM variable used as a proxy for public teacher union membership is also subject to error. A state which experiences a decline in NEA membership may actually be experiencing an increase in teacher union membership if the rival AFT is gaining members in that state. Unfortunately, AFT membership data is not available on a state-by-state basis. This lack of data concerning AFT membership also meant that no measure of interunion rivalry could be developed for this model. An additional problem with the NEA measure is the unification of local NEA organizations which took place in the early 1970s. Although an attempt was made to remove any bias caused during the change in reporting membership data, one cannot be sure of the true membership measures prior to unification.

A problem with many of the independent variables used in this study is with the specification of the data itself. Measures, such as UNEM, NONAG, LAG2, EXPPUP, and PCTFEM, are based on a given state's average. There may be a large degree of state variation with these measures leading to faulty correlation estimates. An improved measurement could be obtained by using school district data or by further segmenting the state average measures mentioned above.

A major theoretical cause of strike activity is the timing of contract expirations. Unfortunately, no measure of the number of contract expirations involving public school teachers in a given state is available. It is thought that the inclusion of this measure would much improve the results of this study.

Although the NOSTRK variable was found to exhibit a simultaneous equation bias, no other variables were tested for this possibility. William

Moore (15) found evidence of a simultaneous equation bias present in his study with respect to the RTTOWK measure. This possibility is present in this study as well, but is not formally tested.

C. Conclusions

The purpose of this study was to determine the causes of teacher strikes in the public sector. Since public school teachers strike with more frequency than any other group of public employees, it was thought that a successful analysis of this group would also shed light on other public sector strikes as well.

Of the three dependent measures of strike activity examined, the study was most successful in accounting for the number of stoppages. The independent variables seemed to perform best when analyzed in a pooled format which captures the long-run effect of these determinants. The NSTOP pooled format with the state dummy variables included accounted for approximately 74 percent of the variability in the number of stoppages in this study. Considering the large degree of variation involved with the measures used in this cross-section, this result is surprising.

One of the most successful independent measures used in the model was the LAG2 variable. The LAG2 measure was based upon a weighted two-period change in real wages developed by Ashenfelter and Johnson (1). All sixteen regressions exhibited the hypothesized negative coefficient with thirteen of these being significant. The reader may recall that the mean of the LAG2 measure was negative for each year examined in this study. This result strongly implies that a decrease in real wages increases the level of public teacher strike activity.

Another variable displaying good results across the sixteen regressions performed was the quadratic term NAGSQ, as seven of these cases were significant. The NTEACH variable used to account for differing state teacher populations in the absolute model specification also displayed good results. Of the eight cases in which this variable was used, five were significant. This result tends to support the hypothesis that, as the population of public teachers in a given state increases, so does the level of public teacher strike activity.

Of special interest is the performance of the legal variables when regressed on the number of stoppages. Both MDUTY and NOSTRK are negative and significant when analyzed in the transformed format. The coefficient on NOSTRK remains negative and significant when analyzed in the absolute specification, but the sign on MDUTY changes to positive and insignificant. It would appear as though the enactment of a no strike law has the desired effect of decreasing the number of stoppages involving public school teachers. Although the MDUTY measure was not as successful as the NOSTRK variable, it appears as though the performance of this NOSTRK measure has improved from the lengthened time frame of study. The reader may recall that the performance of the legal determinants performed poorly in earlier studies. Those were undertaken soon after the passage of the majority of state laws concerning public employee bargaining rights. The more recent period of analysis in the present investigation may have been able to capture a more stable period. However, this study is limited to a relatively small segment of the total public sector workforce and caution should be exercised before making any broad policy implications based on the success of this limited study.

Possible improvement in this study may be to include a measure of teacher wages in relation to other "professional" employees. An additional consideration would be to relate the level of strike activity in other groups of public employees to strike activity involving public school teachers. These considerations may improve measures pertaining to economic and unionization measures. However, it seems unlikely that further specification of this model will result in vastly improved results, unless the in-state variability in both the dependent and independent measures used in this study can be better controlled.

VII. BIBLIOGRAPHY

1. Ashenfelter, Orley, and Johnson, George. "Bargaining Theory, Trade Unions, and Industrial Strike Activity." *American Economic Review* 59 (March 1969): 35-49.

2. Britt, David W., and Galle, Omer. "Structural Antecedents of the Shape of Strikes: A Comparative Analysis." *American Sociological Review* 39 (October 1974): 642-51.

3. Burton, John F., Jr., and Krider, Charles E. "The Incidence of Strikes in Public Employment." In *Labor in the Public and Nonprofit Sectors*, pp. 135-77. Edited by Daniel S. Hammermesh. Princeton, New Jersey: Princeton University Press, 1975.

4. Cohen, Sanford. *Labor in the United States.* 5th ed. Columbus, Ohio: Merrill Publishing Co., 1979.

5. Eaton, Curtis B. "The Worker and the Profitability of the Strike." *Industrial and Labor Relations Review* 26 (October 1972): 670-79.

6. Eisele, Frederick C. "Organization Size, Technology, and Frequency of Strikes." *Industrial and Labor Relations Review* 27 (July 1974): 560-71.

7. Flaherty, Sean. "Contract Status and the Economic Determinants of Strike Activity." *Industrial Relations* 22 (Winter 1983): 20-33.

8. Hicks, J. R. *The Theory of Wages.* 2nd ed. London, England: Lowe and Brydone LTD, 1963.

9. Kaufman, Bruce E. "Interindustry Trends in Strike Activity." *Industrial Relations* 22 (Winter 1983): 45-57.

10. Kaufman, Bruce E. "The Determinants of Strikes in the United States, 1900-1977." *Industrial and Labor Relations Review* 35 (July 1982): 473-90.

11. Krislov, Joseph. "Work Stoppages of Government Employees, 1942-59." *Quarterly Review of Economics and Business* 1 (February 1961): 87-92.

12. McClain, J. D. "How College-Age Voters View the Right to Unionize and Strike." *Public Personnel Management* 2 (March 1973): 125-27.

13. McLean, Robert A. "Interindustry Differences in Strike Activity." *Industrial Relations* 18 (Winter 1979): 103-09.

14. Mitchell, Daniel J. B. "A Note on Strike Propensities and Wage Developments." *Industrial Relations* 20 (Winter 1981): 123-26.

15. Moore, William J. "Membership and Wage Impact of Right-to-Work Laws." *Journal of Labor Research* 1 (Fall 1980): 349-68.

16. Moskow, Michael H.; Loewenberg, Joseph J.; and Koziara, Edward C. *Collective Bargaining in Public Employment.* New York: Random House, Inc., 1970.

17. National Education Association. *N.E.A. Handbook.* Washington, D.C.: N.E.A. Publishing, 1971-1981. Various issues.

18. Rees, Albert. "Industrial Conflict and Business Fluctuations." *The Journal of Political Economy* 60 (October 1952): 371-82.

19. Rees, Albert. *The Economics of Trade Unions.* 2nd ed. Chicago: The University of Chicago Press, 1977.

20. Shirom, Arie. "Strike Characteristics as Determinants of Strike Settlements: A Chief Negotiators Viewpoint." *Journal of Applied Psychology* 67 (February 1982): 45-52.

21. Snarr, Neil D. "Strikers and Nonstrikers: A Social Comparison." *Industrial Relations* 14 (October 1975): 371-74.

22. Stagner, Ross, and Eflal, Boaz. "Internal Union Dynamics During a Strike: A Quasi-Experimental Study." *Journal of Applied Psychology* 67 (February 1982): 37-44.

23. Stieber, Jack. "Comment: The Incidence of Strikes in Public Employment." In *Labor in the Public and Nonprofit Sectors,* pp. 178-82. Edited by Daniel S. Hammermesh. Princeton, New Jersey: Princeton University Press, 1975.

24. Tomkiewicz, Joseph. "Determinants of Teacher Militancy: Factors Affecting the Decision to Strike." *Journal of Collective Negotiations in the Public Sector* 8 (January 1979): 91-96.

25. Torrence, William D. "City Public Employee Work Stoppages: A Time-Line Analysis for Educational Purposes." *Labor Law Journal* 27 (March 1976): 177-83.

26. U.S. Department of Commerce. Bureau of the Census. *Current Population Reports, Series P-25.* Washington, D.C.: U.S. Government Printing Office. Various issues.

27. U.S. Department of Commerce. Bureau of the Census. *Statistical Abstract of the United States.* Washington, D.C.: U.S. Government Printing Office, 1971-1983. Various issues.

28. U.S. Department of Health, Education, and Welfare. National Center for Education Statistics. *Statistics of Public Elementary and Secondary Day Schools*. Washington, D.C.: U.S. Government Printing Office, 1969-1980. Various issues.

29. U.S. Department of Health, Education, and Welfare. Office of Education. *Digest of Educational Statistics*. Washington, D.C.: U.S. Government Printing Office, 1970-1981. Various issues.

30. U.S. Department of Labor. Bureau of Statistics. *Work Stoppages in Government*. Washington, D.C.: U.S. Government Printing Office, 1972-1980. Various issues.

31. U.S. Department of Labor. Labor-Management Services Administration Division of Public Employee Labor Relations. *Summary of State Policy Regulations for Public Sector Labor Relations*. Washington, D.C.: U.S. Government Printing Office, 1971-1981. Various issues.

32. White, Sheila C. "Work Stoppages of Government Employees." *Monthly Labor Review* 92 (December 1969): 29-34.

33. Young, James E., and Brewer, Betty L. "Strikes by State and Local Government Employees." *Industrial Relations* 9 (May 1970): 356-61.

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IX. APPENDIX A: OMITTED VARIABLES

	Omitted variable	Reason for omission
1)	Yearly percentage change in NEA membership	Correlated with number of NEA members
2)	No strike law with penalty	Correlated with no strike law
3)	Income per capita	Correlated with expenditures per pupil
4)	Student-teacher ratio	Preliminary analysis showed little or no effect
5)	Number of school districts	Preliminary analysis showed little or no effect

NOTE: Additional information concerning these omitted variables is available from the author upon request.

X. APPENDIX B:

MEANS WITH STANDARD DEVIATIONS

Table 10-1. Means with standard deviations[a]

Variable name	1972	1973	1974	1975	1976
NSTOP	1.706 (3.613)	2.294 (5.281)	2.607 (6.873)	4.274 (9.962)	2.705 (7.685)
NNSTOP	0.000037 (0.000089)	0.000043 (0.000078)	0.000043 (0.000087)	0.000107 (0.00026)	0.000044 (0.000082)
NWKIN	664.71 (1407.8)	1007.84 (3290.28)	1179.41 (2642.39)	3574.51 (10860.12)	1276.47 (2989.96)
NNWKIN	0.02713 (0.0884)	0.03304 (0.1435)	0.02736 (0.0884)	0.0682 (0.146)	0.0224 (0.05)
DUR	4064.71 (12392.3)	12172.55 (59486.05)	10535.29 (28437.95)	27835.29 (82654.24)	13986.27 (52459.78)
NDUR	0.0925 (0.2681)	0.3366 (1.5269)	0.2047 (0.5517)	0.5471 (1.2847)	0.2065 (0.5997)
NONAG	23.14 (8.85)	22.66 (8.74)	22.15 (8.7)	21.85 (8.59)	21.51 (8.52)
NAGSQ	613.87 (445.44)	588.64 (431.7)	564.96 (421.92)	549.78 (408.5)	533.91 (398.66)
RTTOWK	0.3725 (0.488)	0.3725 (0.488)	0.3725 (0.488)	0.3725 (0.488)	0.3921 (0.493)
NEAMEM	32459.08 (36241.97)	33595.65 (37515.8)	34457.14 (38587.5)	36105.47 (41405.56)	36881.76 (41226.99)
NNEAMEM	0.7957 (0.2187)	0.8099 (0.2113)	0.8301 (0.2227)	0.8253 (0.2079)	0.8482 (0.2107)
NOSTRK	0.647 (0.482)	0.686 (0.468)	0.706 (0.46)	0.725 (0.451)	0.745 (0.44)
MDUTY	0.451 (0.502)	0.51 (0.505)	0.524 (0.504)	0.549 (0.503)	0.569 (0.5)

UNEM	5.402 (1.64)	4.902 (1.497)	5.561 (1.502)	8.025 (2.153)	7.155 (1.919)
LAG2	-3.753 (0.018)	-4.698 (0.022)	-8.537 (0.026)	-9.97 (0.027)	-7.369 (0.029)
EXPPUP	908.24 (233.18)	922.86 (218.59)	942.78 (205.16)	1025.7 (263.7)	1050.52 (263.42)
PCTSMSA	58.23 (25.96)	59.5 (26.06)	59.57 (26.02)	59.82 (25.69)	59.78 (25.66)
SMSASQ	4051.24 (2766.49)	4205.94 (2836.25)	4212.07 (2835.89)	4225.94 (2824.47)	4219.4 (2818.72)
PCTFEM	66.79 (6.94)	66.66 (6.88)	66.54 (6.95)	66.41 (7.08)	66.62 (7.08)
NTEACH	40896.08 (43113.46)	41668.51 (43327.3)	41784.31 (43447.19)	43198.18 (44957.19)	43294.12 (45057.23)

[a]Standard deviations in parentheses.

Table 10-1. *Continued*

Variable name	1977	1978	1979	1980	Pooled
NSTOP	2.176 (4.761)	2.451 (6.113)	3.549 (8.927)	4.549 (10.92)	2.924 (7.486)
NNSTOP	0.000029 (0.000054)	0.000053 (0.000094)	0.000058 (0.00011)	0.000069 (0.00013)	0.000054 (0.00012)
NWKIN	1070.59 (2641.99)	979.41 (2241.45)	1149.1 (2404.69)	2108.82 (6647.63)	1445.64 (4845.82)
NNWKIN	0.01391 (0.0363)	0.0202 (0.0369)	0.03747 (0.1433)	0.0262 (0.667)	0.0306 (0.099)
DUR	11829.41 (42165.5)	10872.55 (36047.71)	16325.49 (39930.07)	25293.14 (90284.79)	14768.3 (54656.82)
NDUR	0.1707 (0.7614)	0.1576 (0.3731)	0.576 (2.456)	0.2765 (0.8563)	0.2854 (1.165)
NONAG	21.01 (8.27)	20.05 (8.09)	21.49 (7.7)	22.48 (7.45)	21.87 (8.3)
NAGSQ	508.32 (380.11)	484.57 (366.65)	519.98 (356.66)	559.59 (354.22)	547.07 (395.59)
RTTOWK	0.3921 (0.493)	0.3921 (0.493)	0.3921 (0.493)	0.3921 (0.493)	0.3834 (0.487)
NEAMEM	36670.49 (41799.22)	36854.8 (41813.83)	37256.2 (41670.08)	36624.2 (41172.6)	35656.09 (39889.57)
NNEAMEM	0.8294 (0.217)	0.8503 (0.2291)	0.8629 (0.2301)	0.8535 (0.2395)	0.8339 (0.22)
NOSTRK	0.745 (0.44)	0.745 (0.44)	0.725 (0.451)	0.725 (0.451)	0.717 (0.451)

MDUTY	0.569 (0.5)	0.608 (0.493)	0.608 (0.493)	0.608 (0.493)	0.556 (0.497)
UNEM	6.659 (1.612)	5.737 (1.524)	5.559 (1.406)	6.796 (1.618)	6.2 (1.91)
LAG2	-6.078 (0.027)	-7.031 (0.029)	-9.427 (0.03)	-12.311 (0.041)	-7.686 (2.539)
EXPPUP	1126.14 (382.08)	1116.07 (264.72)	1142.22 (279.85)	1128.67 (289.73)	1040.36 (282.45)
PCTSMSA	60.33 (24.95)	60.33 (24.87)	60.33 (24.91)	60.33 (24.91)	59.8 (25.24)
SMSASQ	4249.28 (2783.01)	4246.44 (2774.22)	4247.99 (2778.62)	4247.99 (2778.62)	4211.81 (2775.79)
PCTFEM	67.54 (8.07)	67.04 (7.1)	67.25 (7.15)	67.45 (7.23)	66.92 (7.12)
NTEACH	43087.78 (43277.97)	42666.67 (42915.18)	(2754.98) (42154.11)	42352.94 (41154.61)	42411.51 (42909.65)

XI. APPENDIX C:

F-TESTS: MODEL WITHOUT STATE DUMMY VARIABLES

Table 11-1. F-tests: Model without state dummy variables[a,b]

Dependent variable	F-test			
	Slope[a] NONAG and NAGSQ	NONAG=0 NAGSQ=0	Slope[b] PCTSMSA and SMSASQ	PCTSMSA=0 SMSASQ=0
NSTOP	19.7479 (0.0001)***	26.0626 (0.0001)***	2.1072 (0.1473)	1.1616 (0.3139)
NNSTOP	2.1609 (0.1424)	1.1992 (0.3025)	1.3646 (0.2434)	0.6842 (0.5051)
NWKIN	5.8356 (0.0161)**	7.9817 (0.0004)***	0.3171 (0.5736)	0.3324 (0.7174)
NNWKIN	1.9461 (0.1637)	2.281 (0.1034)	7.5886 (0.0061)***	3.7958 (0.0232)**
DUR	6.9438 (0.0087)***	9.3111 (0.0001)***	0.4564 (0.4997)	0.2437 (0.7838)
NDUR	2.5464 (0.1113)	2.783 (0.0629)*	5.3223 (0.0215)**	2.711 (0.0676)*

[a]Slope test - Slope = $\frac{\partial \text{ dependent variable}}{\partial \text{ NONAG}}$

= NONAG + 2*(MEAN NONAG)*NAGSQ.

[b]Slope test - Slope = $\frac{\partial \text{ dependent variable}}{\partial \text{ PCTSMSA}}$

= PCTSMSA + 2*(MEAN PCTSMSA)*SMSASQ;

Null hypothesis is: Slope = 0.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

XII. APPENDIX D: F-TESTS: MODEL WITH STATE DUMMY VARIABLES

Table 12-1. F-tests: Model with state dummy variables[a,b]

Dependent variable	F-test			
	Slope[a] NONAG and NAGSQ	NONAG=0 NAGSQ=0	Slope[b] PCTSMSA and SMSASQ	PCTSMSA=0 SMSASQ=0
NSTOP	1.2809 (0.2584)	0.9725 (0.379)	2.5512 (0.111)	1.3379 (0.2636)
NNSTOP	2.1609 (0.1424)	1.1992 (0.3025)	1.3646 (0.2434)	0.6842 (0.5051)
NWKIN	0.1125 (0.7375)	0.2068 (0.8132)	0.2626 (0.6086)	0.1331 (0.8754)
NNWKIN	1.8696 (0.1723)	1.6383 (0.1956)	0.006 (0.9813)	0.003 (0.997)
DUR	0.2730 (0.6016)	0.2827 (0.7539)	0.1351 (0.7134)	0.068 (0.9343
NDUR	0.3757 (0.5403)	0.3823 (0.6826)	0.1001 (0.7519)	0.0537 (0.9477)

[a]Slope test - Slope = $\frac{\partial \text{ dependent variable}}{\partial \text{ NONAG}}$

= NONAG+2*(MEAN NONAG)*NAGSQ.

Null hypothesis is: Slope = 0.

[b]Slope test - Slope = $\frac{\partial \text{ dependent variable}}{\partial \text{ NONAG}}$

= PCTSMSA+2*(MEAN PCTSMSQ)*SMSASQ.

Null hypothesis is: Slope = 0.