The Impact of Performance Based Pay Incentives on the Attrition of American Public School Teachers

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Abstract:

Over the past half century, the vast majority of "white collar" occupations have adopted a compensation structure with flexible wages that reward and punish based on ability. The public educational sector, unlike its private counterpart, has been very reluctant to adopt such a wage structure. Despite requiring a college degree as well as specific training, teacher compensation is centrally determined, with wages based on experience and education level, as opposed to ability. This wage structure has frustrated many young teachers, causing them to leave the profession en masse (Schlenty and Vance, 1981). Recently certain schools have started rewarding bonuses to teachers based on their performance. "Merit pay" is believed to encourage young competent teachers to stay in the profession and drive out less qualified individuals. With data provided by the National Center for Education Statistics, I use a series of probit models to analyze the effect of merit pay on both the attrition and movement of young teachers while controlling for both school level and personal characteristics.

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"Teaching seems to have more than its share of status anomalies. It is honored and disdained, praised as 'dedicated service' and lampooned as 'easy work.' It is permeated with the rhetoric of professionalism, yet features incomes below those earned by workers with considerably less education. It is middle-class work in which more and more participants use bargaining strategies developed by wage earners in factories." (Lortie, 1975 10).

Introduction:

The American public education sector is having difficulty attracting and retaining qualified and motivated teachers. Offering low compensation and an inflexible wage structure, with raises commensurate with experience and education as opposed to ability, the nation's best and brightest often spurn education for more lucrative sectors like law, medicine, or business. Moreover, many young idealistic educators enter teaching but quickly become disillusioned by the monotony, disrespect, and often outright hostility that come with the profession. Their older counterparts, who might be ineffective and incompetent, earn a much higher salary while often putting in little effort. As a result, the turnover of young teachers is high.

Recently, many schools have begun rewarding bonuses to teachers based on performance. These bonuses, ranging anywhere from 1 percent to up to 10 percent of a teacher's salary, represent a contrast to the hierarchical wage structure that is typical in most public schools. Though some questions remain as to the efficacy of targeting the correct individuals with these bonuses, they can serve as both a powerful monetary incentive and morale boost which helps to keep young, motivated teachers in the profession.

Using data provided by the National Center for Education Statistics, my series of probit models depict the relationship between receiving merit pay and an inexperienced teacher either leaving teaching altogether, moving to a different school, or staying at their same position while controlling for school and demographic characteristics. I expect that merit pay will act as an incentive to both keep inexperienced teachers in the profession and retain their current position.

Literature Review:

The American public educator is one of the most under-compensated and under-appreciated workers, despite the fact that it has a profound impact on developing human capital. Schools have always had problems attracting qualified individuals. Traditionally, the school teacher was faced with the task of educating a largely rural population who would likely end up working in agriculture and would require just a basic working knowledge of reading and arithmetic in order to subsist. Parents were responsible for the majority of their child's intellectual development (Butts and Cramer, 1953). Moreover, as the United States began to urbanize, the classroom was seen as a "stepping-stone" of sorts towards assimilation into the industrial world. A strict schedule, repetitive tasks such as rote memorization and writing exercises, as well as the use of corporal punishment for even the slightest infraction was meant to prepare the student to one day work under similar conditions in one of a growing number of US factories (Hansen, 1956).

This system of education was adequate when agriculture and manufacturing were the nation's primary employers. However, as we shift to a service-sector economy, highly skilled workers become a necessity and this pedagogical system is rendered ineffective. As labor markets become more and more competitive internationally and a post-secondary education almost compulsory, attracting and retaining qualified primary and secondary school teachers is imperative. Recent studies have shown that the quality of a student's instructor has a significant impact on test scores; so substantial even that a well qualified teacher can often counteract the downward biases caused by socioeconomic factors and large class sizes (Clotfelter et al, 2007).

Wayne and Youngs (2003) examined several studies linking student achievement gains, measured by standardized testing, to teacher characteristics. They reviewed only studies that used appropriate methodology, which they deemed as controlling for intraclassroom socioeconomic factors and that the study uses a “value-added” model that accounts for student achievement in previous years. They find evidence of a positive correlation between student achievement as measured by standardized test scores and selectivity of a teacher’s undergraduate institution (using Barron’s six category selectivity ranking system). Teachers that matriculated from an institution deemed “competitive” were shown to be more effective than teachers who matriculated from an “uncompetitive” institution. An additional positive correlation with student achievement was found between not only high licensure examination test scores, but also ACT composite scores of teachers. They found inconclusive evidence in the correlations between licensure type (national, state, or provisional), field of degree, and possession of an advanced degree.

Clotfelter et. al. (2007) review a detailed data set of North Carolina public schools to study the link between student achievement and teacher credentials. Using a standard value added model which controlled for the socioeconomic characteristics of students, they found positive relationships between student achievement and a teacher’s experience, competitiveness of undergraduate university, possessing a regular license (as opposed to provisional or emergency), having a high licensure test score, and being nationally certified. Furthermore, a teacher who went to a competitive undergraduate college, has ten years of experience, possesses a regular license, has an average license score, and is nationally certified has average classroom test scores that are 15 to 20 percent higher in math and 8 to 12 percent higher in reading than a teacher that went to a non-competitive undergraduate university, has no experience, has a non-regular license, has test scores one standard deviation below the average, and is not nationally certified. One counterintuitive finding of this study was that despite the fact that the possession of an advanced degree almost always led to an increase in salary, it actually led to lower average test scores when experience was taken into account. This would lead one to suggest that such a pay structure is not a good use of a school district’s limited funds, aside from the fact that it helps to keep experienced teachers in the profession.

Despite this immense importance of attracting qualified teachers, education is one of the only "white collar" sectors in which no causal link exists between earnings and ability. Sander (2007) attempted to determine if a teacher's cognitive ability was positively correlated with their salary. Using data from the National Opinion Research Center's General Society Survey (GSS), he constructed an OLS model with the natural log of earnings as the dependent variable. In the model, several demographic characteristics such as region, experience, and education level are used as explanatory variables. Also included is the score of an aptitude test consisting of 10 vocabulary questions, which was given to all respondents in the GSS. The test score was not found to have a statistically significant impact on earnings for teachers. Other characteristics, such as educational level and experience, had a much greater impact on earnings. The same model was run with several other occupations: retail trade, real estate, production, and professional. An individual's test score was found to have a positive effect on wages in every case. Sander suggests that the wage structure in the education sector is the cause of this inconsistency.

Because of these discrepancies in teacher aptitude and salary, there has been a push for performance-based pay for teachers. Proponents of merit based pay believe it to be a possible solution to the high turnover rates and low productivity of young teachers by inducing better qualified individuals to enter the profession (Belfield and Heywood, 2004). However, its detractors point out that, in many cases, education is a "team product" and it can be difficult to ascertain who deserves the credit. However, this could be viewed as a positive, as this would encourage collaboration and the fortification of a formal teaching network.

Belfield and Heywood conducted an analysis of the determinants of merit based pay and found that teachers who formed explicit cooperation networks as well as those with a higher degree of job satisfaction were more likely to receive merit based pay. Additionally, women were more likely than men to receive performance based pay. However, these results may not be a foreshadowing of the effects of a large-scale merit based pay system, as in the available data set, merit pay on average raised an individual's total salary by only about 2 to 3 percent, though the authors speculate that this average could be dragged down by unproductive teachers, and well-qualified teachers could have seen gains of 10 percent or more.

These findings could lead one to believe that performance based pay will act as an incentive to keep young, well qualified teachers in the profession. It circumvents the traditional hierarchical wage structure of the education profession that puts young teachers at a disadvantage, and is often based on student achievement, an area in which a teacher's credentials play a positive role. Moreover, the acknowledgment of superior work that is intrinsic in a performance related bonus could provide a much needed morale boost to the often overwhelmed young and inexperienced teachers. Performance based bonuses appear to be one step in the right direction towards attracting and retaining qualified teachers.

Despite these perceived benefits of merit pay, teachers' unions have stymied efforts to introduce such a pay structure. Unions have pointed toward myriad objections thrown at merit pay, such as those propagated by Murnane and Cohen (1986), who argue that the lack of a clear proxy to evaluate teacher performance and the potential for opportunistic or non-cooperative behavior to occur in competition for bonuses makes performance based pay "impractical" in the education sector.

Ballou (2001) challenges this assertion of impracticality by conducting an empirical analysis of merit pay in the educational sector. He finds that almost 25 percent of private nonsectarian schools use performance based pay with awards averaging about 10 percent of base pay. However, in the public sector, teachers' unions have an inordinate amount of influence over the actions of school administrators. Often as a direct result of these unions, many merit pay plans are cancelled within a few years of their implementation, regardless of their efficacy. Ballou finds that in districts where teachers do not have union representation, the incidence of merit pay is roughly the same as that of private schools. Additionally, he observes an inverse relationship between the size of merit awards and the degree of union influence. In the quest to create a differentiated teacher salary schedule, unions appear to be one seemingly insurmountable hurdle. Ballou asserts that merit pay will only be embraced in the public sector only if it can be done in a discrete and noncompetitive manner, where awards are not publicized and teachers are not in direct competition with each other. He also cites the need for a mechanism, similar to that which exists in private schools, to dismiss recalcitrant teachers who publicly complain about their salary.

Along with the inability to dismiss incompetent and recalcitrant teachers, attrition of qualified individuals has plagued the teaching profession for decades. Shen (1997) conducted a study of teacher attrition and retention. He found that teachers with less experience, especially those in their first year and those in economically depressed districts were much less likely to matriculate. In order to counter these alarming attrition trends, Shen suggests building a “career ladder” in teaching; allowing for more deference and decision making at the teaching level as well as creating a more flexible salary schedule, with raises based on teacher ability rather than experience.

The current educational hierarchy puts young and competent teachers at a particular disadvantage. By becoming teachers, they are incurring a significant opportunity cost, forgoing the often lucrative salary available in other professions. Schlenty and Vance (1981) performed an analysis of the correlation of retention rates of teachers in North Carolina between 1973 and 1980 with their score on the National Teacher Examination, an aptitude test highly correlated with grade point average, GRE scores, and SAT scores. They found a strong negative correlation between academic ability as measured by the NTE, and retention in teaching. For example, white females ranked in the top 10 percent on the NTE had a cumulative retention rate of 37.3 percent, while those ranked in the bottom 10 percent had a retention rate of 62.5 percent. Similar patterns occur for males. The authors cite the increasing growth of prestigious and well-compensating jobs in the service sector as well as the new occupational opportunities created by the women’s rights movement as the key reasons for this exodus.

The authors go on to suggest that reforms of teacher's education will not have any chance of attracting qualified teachers unless they are coupled with wage differentiation and a restructuring of the teachers working environment. If the teacher education curriculum becomes more rigorous with its current hierarchical wage structure remaining intact, it will likely repel, rather than attract qualified individuals, as they can obtain a higher salary and more respected job in another sector for roughly the same commitment.

As the positive impact of well-qualified teachers on student achievement is clearly discernible, but attrition rate of these teachers is clearly a major issue, we are left with the dilemma: What is the best way to keep qualified teachers in the profession? Basic economic theory would suggest that this can be accomplished by implementing a decentralized wage structure; linking compensation with student achievement by providing higher salaries to those able to raise student's test scores and lower salaries to those who fail to do so. Unfortunately, as Shen (1997) laments, teaching is "permeated with an egalitarian ethos."

My model will examine the impact on teacher attrition in instances where cracks have been made the egalitarian ceiling of public schoolteacher's salaries. I will analyze the impact of performance based pay on teacher attrition. Using a detailed data set provided by the National Center for Education Statistics, I hope to find that performance based bonuses reduce the rate of attrition among young teachers.

Model:

My analysis centers on the labor market of public school teachers. Currently, in the vast majority of districts, a teacher's wage is centrally determined. All incoming teachers are given the same wage, and raises are contingent on experience, certification, and achieving an advanced degree. Additionally, once a teacher passes their probationary period of 4 to 5 years, they are given tenure, making dismissal difficult, even for dismal performance.

Figure 1 in the appendix depicts the employment of high quality and low quality teachers under a uniform wage. This wage structure will create a surplus of low quality teachers and a shortage of those that are highly qualified. The supply of high quality teachers is elastic, as these individuals could find employment in other sectors which command a higher wage. The supply of low quality individuals is less elastic as they will have few alternative employment options to teaching. With the current wage schedule almost perfectly uniform and very low compared to other sectors, it will not attract many highly qualified individuals. Schools will likely attract a surplus of low quality teachers. In order to fill all open teaching positions, administrators must hire less high quality teachers and more low quality teachers than they would otherwise desire.

Figure 1 does show a small number of highly qualified individuals employed as teachers under the uniform wage, represented by E_H. Despite a wage structure that doesn't reward based on ability; some individuals may still choose to become teachers for purely altruistic purposes, possessing a true desire to educate future generations. Others will be motivated by the job security, minimal workload, and relatively low barriers to entry. Individuals in the latter category will tend not to be as qualified as those in the first or those motivated purely by economic reasons. These teachers are represented in figure 1 as E_L and substantially outnumber high quality teachers. These individuals, who are not as likely to succeed in jobs with performance based pay schedules, will be more likely to remain as teachers than their more skilled peers. A merit based pay structure would help to mitigate these issues of adverse selection. Furthermore, it will help to retain qualified young teachers by tying pay to performance.

Some districts have begun implementing performance based pay incentives in an attempt to retain qualified teachers. As stated previously, these bonuses are typically fairly small; often consisting of less than $500, but sometimes can reach 5 or even 10 percent of a teacher’s salary. Not only do these bonuses act as a monetary incentive to retain qualified instructors, but they also provide a much needed morale boost for often unappreciated young teachers. Performance based policies will not intrinsically reward teachers on the sole issue of experience, thus leveling the playing field between talented young teachers and their older counterparts. I hypothesize that as a result of the monetary incentive coupled with a morale boost, instances of merit pay will decrease the likelihood of an inexperienced teacher leaving the profession.

Statistical Models:

The impact of merit pay on teacher attrition could best be examined with a series of binary limited dependent probit models, with the dependent variable being “1” if the teacher left the profession and “0” if the individual stayed in period t.

The models are:

$$\Pr(LTeach\_t=1 \mid X_1 = x_1) = \Phi(X_{1B})$$

$$\Pr(LTeach\_t=1 \mid X_2 = x_2) = \Phi(X_{2B})$$

Where *Lteach_t* represents an individual leaving teaching in period t, X_i represents a vector of regressors, Φ represents the cumulative distribution function of a standard normal distribution and XB represents a vector containing the marginal impact of each member of X_{ib} on influencing *Lteach_t* (produced by maximum likelihood estimation).

X_1 represents the characteristics of single individuals and X_2 represents those that are married. I chose to run two different models as decision making in a married household is likely dependent on the entire family's income rather than just one member (assuming both spouses are working). Additionally, married couples are much more likely to have children, which would have an additional impact on their decision to leave or stay in teaching. As a result, it made little sense to analyze single and married individuals using the same model.

The vector X_i consists of several variables, both individual-level and school level characteristics from period t-1. The amount of merit pay received in time period t-1 was included in both models as categorical variables in ranges from under \$500, \$500 to \$999, \$1000 to \$1999, and over \$2000. In both samples, the student-teacher ratio, the percentage of students receiving free or reduced lunch, the percentage of students with limited English proficiency, and the percentage of students with independent education plans were included as school level characteristics. Race (black or non-black), gender, union membership, and possession of a Master's degree were included as personal characteristics in both models. Additionally, the number of dependents was included as a personal characteristic in the married subgroup. Teacher salary (categorical variables ranging from less than \$30,000 to over \$50,000) was included as the income variable in the single model. Family income (categorical variables ranging from less than \$20,000 to over \$100,000) was used in lieu of teacher salary for the married subgroup. A categorical variable indicating 1 if the individual would become a teacher again and 0 otherwise and a variable indicating 1 if the individual thought discipline was a problem at their school and 0 otherwise were included as job perception variables. Additionally, an interaction variable between high poverty schools and receiving a merit pay bonus was also included for both subgroups.

These first three variables serve as proxies to the poverty level and the overall desirability of the school. The percentage of students receiving reduced lunch is used by the United States Department of Education as an indicator of the poverty level of a school. A student is eligible for reduced lunch if his family's income is below 130 percent of the poverty line and is eligible for reduced lunch if his family's income is between 130 and 185 percent of the poverty line. Schools in which over 50 percent of students receive free or reduced lunch are considered “high poverty” schools (United States Department of Agriculture). These schools are often located in high-crime areas and may provide a hostile and unsafe working environment.

Student teacher ratio is also negatively correlated with a school's desirability. Except under special situations, a student-teacher ratio of over 25 is considered “overcrowded” (Planty et. al, 2008).

Classes with too many students can be difficult both to enforce proper behavior and also prepare a standardized curriculum, as larger classes generally have students with greater variation in aptitude. Hence, teachers generally prefer smaller class sizes which are more prevalent in affluent school districts.

Additionally, percentage of students with limited English proficiency as well as the percentage of students with independent education plans can also negatively affect a school's desirability. A school with a high portion of students with limited English proficiency can make instruction difficult, especially if the teacher is not familiar with the students' native language. This additional obstacle can add an unnecessary element of stress to the already overburdened public school teacher. Also, a high number of students with individual education plans (IEP) can be an added burden for a financially strapped institution. IEPs are agreements between the parents, administrators, and teachers to provide opportunities for disabled children (Küpper, 2007). Though altruistic and admirable, a school with a high number of students with IEP's can siphon away much needed funds from other areas as well require teachers without special education certification to work with disabled children.

The standard demographic characteristics were included to see attrition habits varied by race, gender, union affiliation, or education level. Teaching has historically been a profession dominated by females (they make up over 70 percent of my subsample). However, females have not typically been the family “breadwinner,” and usually worked to supplement her husband's much larger income. This would lead one to believe that females would be less likely than males to leave the profession.

Though teacher’s unions have effectively quashed most attempts at performance based pay, union membership could potentially decrease attrition rates. Unions can provide legal representation and hearings for individuals dismissed from the profession. This can make it difficult to fire those affiliated with unions. Union members are also eligible for collectively bargained contracts, which often include higher wages and benefits than their non-union counterparts.

Individuals possessing a Master's degree may be more marketable in other professions, and might be making a substantial opportunity cost by staying a teacher. If the degree is in a field like business or a natural science, by staying a teacher, the degree-holder might be forgoing opportunities to work in the lucrative private sector. On the other hand, the possession of a Master's degree in education could represent a substantial sunken cost in the field of education. The degree has little value outside of the educational sector, yet it almost always provides a pay raise and greater degree of job security within education. Given that the majority of teachers possessing Master's degrees likely have it in the field of education, the possession of a degree is expected to decrease the probability of attrition.

The job perception variables were included as a proxy for non-economic factors that could potentially influence attrition. Individuals that stated they would not wish to become a teacher again are dissatisfied with their job. Nonetheless, their job security and the effort required to find a new profession could convince them to stay in teaching. Additionally, teachers who view student behavior as a problem might not only be disheartened with the profession, but also fear for their safety. Both of these are important factors not directly related to one’s pecuniary status, but could still influence their decision to leave teaching.

I also included an interaction variable between teaching at a high poverty school and receiving merit pay. Teachers at these schools are often underpaid and underappreciated. Moreover, these are among the least desirable teaching positions which would lead me to believe a high attrition rate exists in these schools. My interaction variable hopes to gauge the ability of administrators in these districts to retain instructors. I would expect these individuals to respond more positively to a performance based bonus than their counterparts in more affluent districts.

After modeling teacher attrition, I decided to use the same characteristic vectors to predict movement of teachers among different schools. These models are:

$$\Pr(Mover\_t=1 | x\_3=x\_3) = \Phi(x\_3B)$$

$$\Pr(Mover\_t=1 | x\_4=x\_4) = \Phi(x\_4B)$$

Where mover represents an individual moving to a different school in period t and X_i represents a vector of regressors. For data consistency issues, these vectors are slightly different from those used in attrition. Two additional job perception variables, gauging the teacher's influence on policy, and level of collaboration with others, were included. Additionally, due to a limited number of responses, the reduced lunch-merit pay interaction variable was removed from the married subgroup in the movement model. My justification for using these characteristic vectors to model movement lies in the supposition that many individuals may dislike their current teaching environment and seek to find a new one rather than leave the profession entirely. The school-level characteristics and job perception can serve as proxies for the overall desirability of the school. Job perception characteristics such as influence on policy as well as collaboration with others tend to proxy the teacher's feelings about their current teaching situation, not necessarily the profession as a whole. Moreover, individuals in schools with high student teacher ratio, a high percentage of students receiving free or reduced lunch, and a high percentage of students on independent education plans may desire to work at a more affluent school without these characteristics. Additionally, other demographic indicators such as the number of dependents and family income can proxy the opportunity cost of an individual moving to a different position. If a teacher has several children enrolled in school and a working spouse, they would face a greater cost to move to a new district than a single, childless individual.

My movement model will determine if a performance based bonus will mitigate the influence of school-level and demographic characteristics. I hypothesize that a performance based bonus will provide an incentive for an individual to remain in their current location and decrease the probability that they move to another teaching position and that magnitude of the decrease in probability will be positively correlated with the size of the bonus.

Description of Data:

I acquired my data from the public use 1999-2000 Schools and Staffing Survey (SASS) as well as the 2000-2001 Teacher Follow-up Survey (TFS). The SASS is a bi-annual survey, sponsored by the Department of Education, consisting of roughly 40,000 school teachers, principals, and administrators randomly selected from 5000 public school districts and 2500 private schools. The respondents are asked various questions about their demographic characteristics, academic background, salary, and teaching environment. In addition, school level and district level variables are collected. The response rate for this survey is incredibly high, in many years reaching well over 90 percent.

The TFS is conducted amongst a small subsample in the year following the SASS. The TFS tracks teacher attrition, surveying teachers who since the last survey have left the profession, those who have changed schools, and those who have stayed at their previous position. Additionally, the TFS asked about the factors that contributed to their decision to leave or not to leave the profession.

I combined several variables from these two surveys in order to obtain a number of teacher-level as well as school level characteristics. Because I was not able to obtain the more detailed restricted-use version of the SASS and TFS, I was unable to find an adequate proxy for teacher ability, so I centered my analysis on the attrition of teachers with less than 6 years of experience. The reason behind choosing 6 years as the cutoff point is twofold. First, it represents a typical time period before an individual would be eligible for tenure. Once a teacher has tenure, they have considerable job security and are much less likely to leave the profession. Additionally, at this cutoff point, those who entered teaching directly after graduating college would be approaching 30 years of age. Individuals over 30 are generally more risk averse than their younger counterparts, and therefore less likely to leave teaching.

I only included teachers with full or probationary certification in my analysis. These individuals either had or were working toward full accreditation in their field. Those with temporary, provisional, or emergency certification were likely hired during teacher shortages or those participating in programs like "Teach For America" which offer alternative certifications. Because I felt that these individuals did not intend on becoming career teachers and would likely have a disproportionately high attrition rate, I excluded them from my sample. These individuals encompassed less than 5 percent of the aggregate sample, so their exclusion did not significantly alter the data set. I also excluded any teachers that did not possess a Bachelor's degree, as this is an absolute requirement for full time teachers in most districts. As almost 99 percent of respondents possessed a degree, this eliminated a negligible number of respondents.

I also excluded all respondents that were not surveyed in the TFS. No attrition information was available for these individuals, so they served no purpose in my model. This cut my sample from 42,086 individuals, to just 5,788. The sample was further reduced after controlling for experience, certification, and degree level. My final sample included a total of 1,365 teachers, 823 in the married model and 542 in the single model. Table 1 displays the mean and standard deviation of all variables used in my analysis. There are no significant aberrations in demographic characteristics between the two samples. About 70 percent of individuals in both samples are female, 68 percent belong to unions and 20 percent possess Master's degrees. In both samples, teachers tend to work at schools with a higher percentage of students receiving reduced lunch; over 30 percent work in schools in which over 50 percent receive reduced lunch and around 35 percent work in schools in which 20 to 49 percent of students receive reduced lunch. In both samples, less than 10 percent of teachers work at schools in which fewer than 5 percent of students receive reduced lunch. Additionally, about 10 percent of each subgroup receives some sort of performance based bonus.

Figures 2 through 5 depict the distribution of the continuous variables used in my analysis. The distribution of students eligible for reduced lunch is skewed to the right. The majority teach in schools in which less than 50 percent of students are eligible for free or reduced lunch. However, the mode of the distribution is 100 percent, so there is still a considerable portion of the sample that teaches in high poverty areas. The distribution of students with limited English proficiency represents an exponential decline: most respondents teach in schools that have few students with limited English. The student teacher ratio is almost normally distributed, with the mean at about 16.6, the minimum around 1, and the maximum around 37. The number of students with independent education plans also represents an exponential decline with a spike at 100 percent. This likely represents individuals teaching in schools specially designed for disabled children.

Results:

Table 2 in the appendix represents the results of the attrition model of the married subsample. Among married individuals, a merit pay bonus between $1000 and $2000 decreased attrition by 2 percent and a merit pay bonus of over $2000 decreased attrition by 10.5 percent. Union membership, having dependents, and teaching at a high poverty school also contributed negatively to attrition. However, smaller merit bonuses of under $500 and those between $500 and $999 were increased the probability of an individual leaving teaching by 16 percent and 7.8 percent respectively. Other variables that contributed to attrition were possession of a Master's degree, both job perception variables (stating that they would not want to be a teacher again and that they though student behavior was an issue at their school). Additionally, a family income above $100,000 contributed highly towards attrition, increasing its probability by almost 80 percent. A higher student-teacher ratio also contributed positively to attrition. The interaction variable between merit pay and teaching at a high poverty school also positively contributed to individuals leaving teaching.

Table 3 represents the results of the attrition model of the single subsample. Union membership and working in a high poverty school both decreased the probability of attrition by 26 percent and 13.5 percent respectively. Additionally, a merit pay bonus between $1000 and $2000 decreased the probability of attrition by 20.7 percent. On the other hand, merit pay bonuses of less than \$500, between \$500 and \$999, and over \$2000 all contributed positively toward attrition. Other factors that contributed toward increasing the probability of attrition were working in a low poverty school, having a teaching salary greater than \$50,000, possessing a Master's degree, and both job perception variables.

Table 4 shows the results of the movement model of the married subsample. Merit pay between \$1000 and \$2000 and union membership decreased the probability of movement. Merit pay under \$500 and over \$2000 as well as having little collaboration with other teachers, possessing a Master's degree, having a family income above \$100,000, and working at a high poverty school increased the probability of movement.

Table 5 depicts the results of the movement model of the single subsample. Salaries between \$40,000 and \$50,000, merit pay bonuses of less than \$500 as well as the high poverty-merit pay interaction variable all contributed negatively toward teacher movement. Merit pay bonuses over \$2000 or between \$1000 and \$2000, all job perception variables, union membership, and possession of a Master's degree all contributed positively towards movement.

Of the school level characteristics, the most surprising result was that individuals in high poverty schools were less likely to leave the profession than their counterparts in affluent districts and were only slightly more likely to change schools. The likely cause of this anomaly lies in the fact that both subsamples are biased towards individuals working in moderate poverty to high poverty schools. There are few individuals in both subsamples that work in affluent school districts; hence there is more heterogeneity in the teachers working in moderate to high poverty schools. If the sample had a roughly equal number of teachers from low, moderate, and high poverty schools, attrition would likely be more commonplace among those in high poverty areas.

Among demographic characteristics, it was surprising that the possession of a Master's degree made individuals more likely to leave teaching. It is possible that a large portion of the sample had

Master's degrees in fields other than education. It is also possible that much of this sample moves into administrative or other non-teaching positions within the educational sector. In addition to being more likely to leave the profession, those with Master's degrees were more likely to move to other schools. This is likely due to the fact that a Master's degree makes them more marketable within the profession and possession of the degree opens up many new teaching opportunities not available to their less educated counterparts.

Conclusion:

My hypothesis that merit pay would decrease attrition among younger teachers was partially upheld. Depending on the subsample and the amount, merit pay has shown to have both positive and negative influences on teacher attrition and movement. In my series of models, the optimal amount of merit pay appears to be between $1000 and $2000. In both the married and single subgroups, bonuses in this range contributed negatively to teacher attrition. Bonuses of under $1000 and over $2000 had mixed results in terms of attrition and movement. The seemingly counterintuitive results in the bonuses over $2000 could possibly be attributed to the small number of individuals in both subsamples who received bonuses of this magnitude. In addition, the interaction variable was volatile between the married and single subgroups, having a large positive influence on the former and large negative influence on the latter. This is likely a result of the small group of individuals that it encompasses.

Schools wishing to implement merit pay bonuses should initially allot them in the $1000 to $2000 range. Amounts lower than this did not appear to act as a strong incentive to keep teachers in the profession. Additionally, my models did not conclusively show that merit pay bonuses over $2000 were effective in retaining teachers. As most public schools are financially strapped to begin with, it does not make fiscal sense to offer such large performance based bonuses range as there is no conclusive evidence that they retain teachers. As well as providing performance based incentives, schools wishing to retain teachers could focus on improving non-economic factors of the job, such as student discipline and teacher morale.

I was surprised by the exceptionally large impact of the two job perception variables. In every case, the individual's opinion regarding teaching and their assessment of student behavior contributed heavily to their choice to stay in the profession or leave. In addition to examining the effects of performance based pay, future studies should be sure to devote analysis to the non-economic factors of teaching.

Had I greater resources and time on this project, I would seek to create a unique data set in one geographic area such as a school district or state in hopes of minimizing omitted variable bias. I would also try to use a much larger sample containing at least 2000 respondents for each subgroup and track the individuals for a period of several years. Additionally, I would prefer the data to be much more detailed, containing actual salary and bonus amounts rather than categorical variables. I would also hope to obtain both teacher and student test scores some proxy for the quality of the teacher could be factored into the model.

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Appendix

Figure 1 Employment of High Quality and Low Quality Teachers under a Uniform Wage Structure

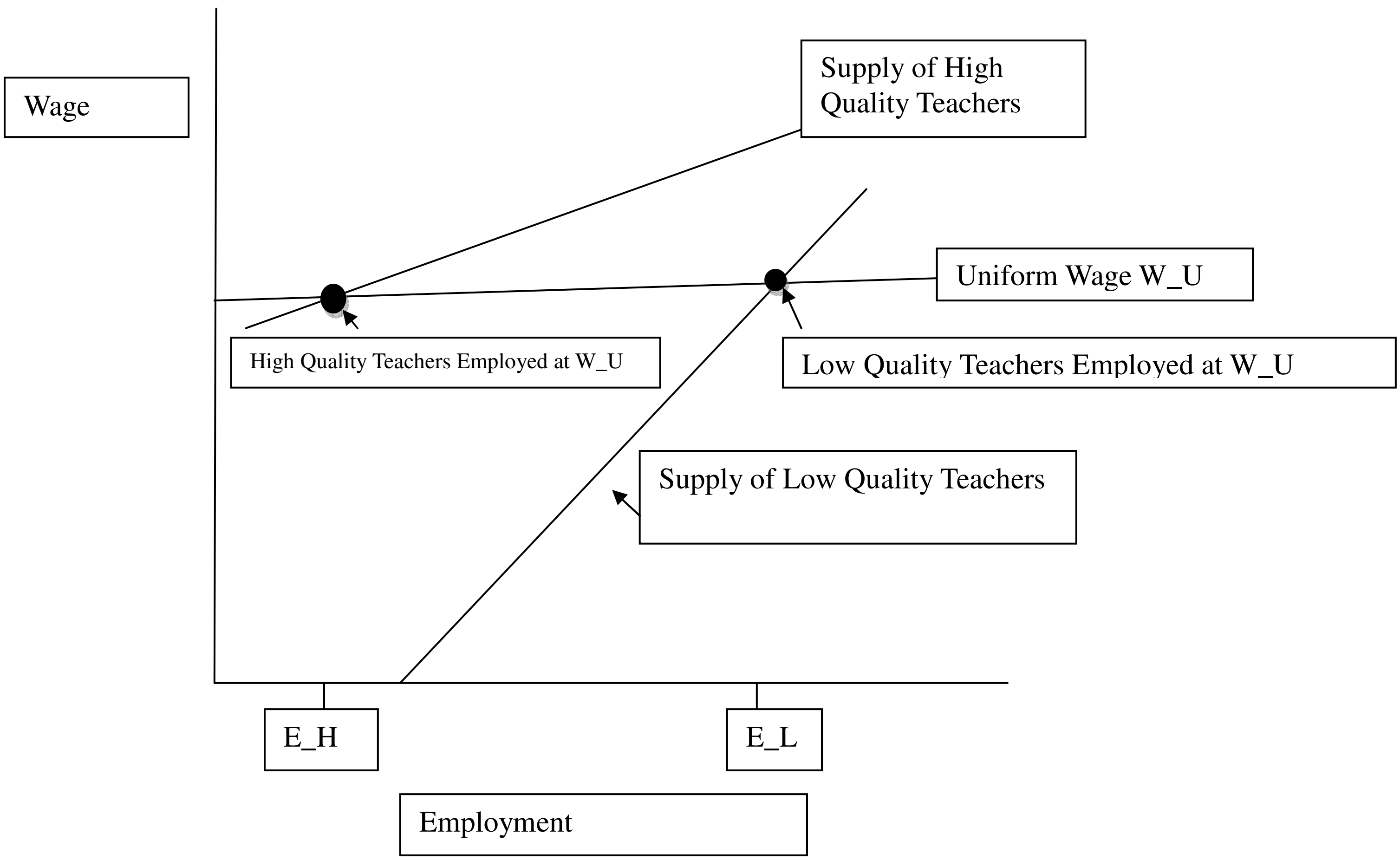

Table 1: Descriptive Statistics of Both Subsamples

Married Subsample: Descriptive Statistics N=823

Variable:	Mean	Standard Deviation
Male	0.30741	0.46170
Black	0.04131	0.19913
More than 50 percent of Students Receive Reduced Lunch	0.32161	0.46740
Less Than 5 percent of Students Receive Reduced Lunch	0.07943	0.27058
20 to 50 percent of Students Receive Reduced Lunch	0.33854	0.47352
Received Merit Pay Bonus of Less than $500	0.02795	0.16492
Received Merit Pay Bonus of Between $500 and $1000	0.03	0.18140
Received Merit Pay Bonus of Between $1000 and $2000	0.02430	0.15408
Received Merit Pay Bonus of over $2000	0.01701	0.12939
Member of a Union	0.68044	0.46659
Total Family Income Under $35,000	0.18105	0.38529
Total Family Income Between $50,000 and $74,999	0.38761	0.48750
Total Family Income Between $75,000 and $99,999	0.16404	0.37053
Total Family Income Over $100,000	0.03281	0.17823
Number of Students With Limited English Proficiency	7.23700	19.21750
Number of Students With Individual Education Plans	17.02590	25.44910
Number of Dependents	1.36695	1.49092
Possesses an MA Degree	0.22478	0.41770
Student-Teacher Ratio	15.38630	4.44020
Would Not be a Teacher Again	0.04374	0.20465
Agree- Student Behavior is a Problem	0.35480	0.47874

Single Subsample: Descriptive Statistics N=542

Variable:	Mean	Standard Deviation
Male	0.32470	0.46870
Black	0.05535	0.22887
More than 50 percent of Students Receive Reduced Lunch	0.31299	0.46417
Less Than 5 percent of Students Receive Reduced Lunch	0.07874	0.26959
20 to 50 percent of Students Receive Reduced Lunch	0.34843	0.47694
Received Merit Pay Bonus of Less than $500	0.03136	0.17446
Received Merit Pay Bonus of Between $500 and $1000	0.04059	0.19752
Received Merit Pay Bonus of Between $1000 and $2000	0.02952	0.16942
Received Merit Pay Bonus of over $2000	0.01845	0.13470
Member of a Union	0.68266	0.46587
Total Teaching Salary Less than $30,000	0.53321	0.49936
Total Teaching Salary Between $40.000 and $49,999	0.05904	0.23591
Total Teaching Salary above $50,000	0.01290	0.11301
Percentage of Students With Limited English Proficiency	7.98950	20.13000
Percentage of Students With Individual Education Plans	16.95290	26.56250
Possesses an MA Degree	0.21586	0.41180
Student-Teacher Ratio	15.27120	4.69129
Would Not be a Teacher Again	0.05535	0.22874
Reduced Lunch-Merit Pay Interaction	0.00923	0.09560
Agree- Student Behavior is a Problem	0.38192	0.48631

Figure 2: Distribution of Percentage of Students Eligible for Reduced Lunch

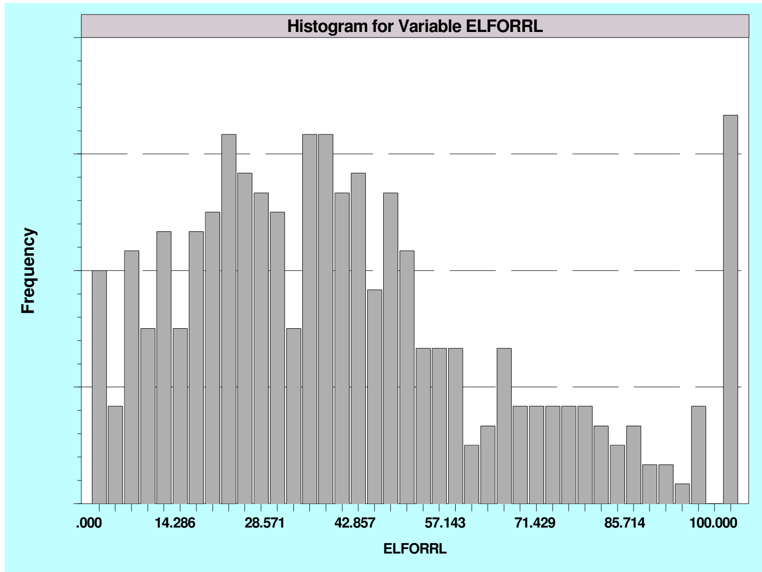

Figure 3: Distribution of Percentage Students With Limited English Proficiency:

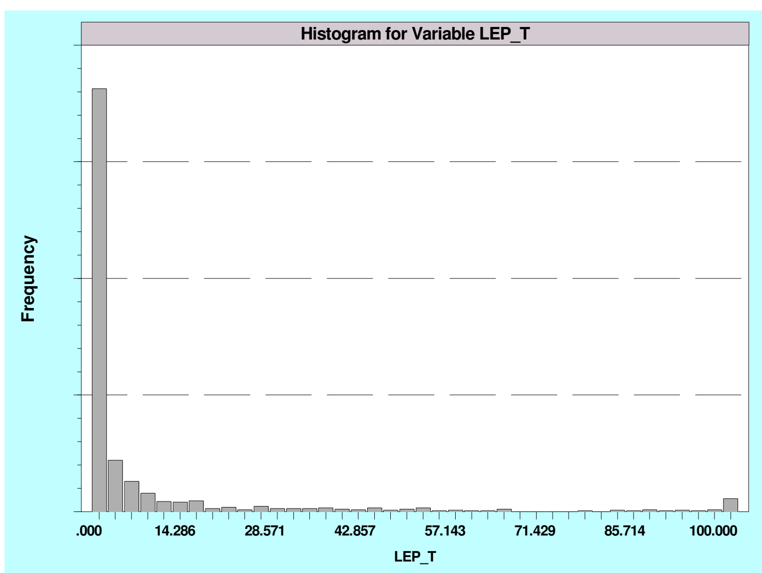

Figure 4: Distribution of Student-Teacher Ratio

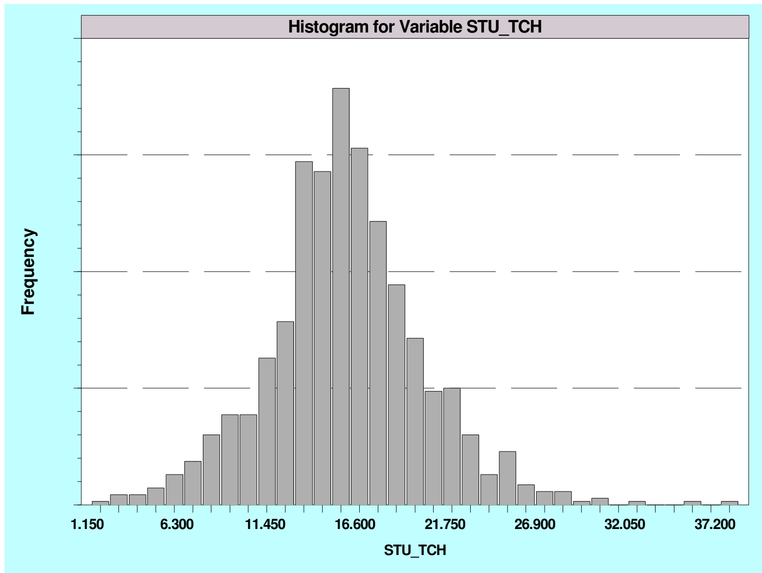

Figure 5: Distribution of Percentage of Students with Independent Education Plans

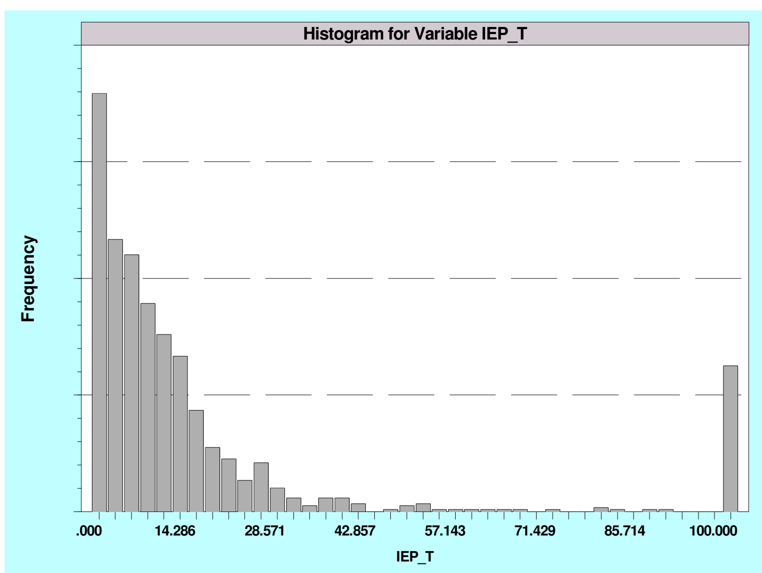

Table 2: Results From Probit Attrition Model: Married Subsample

Results of Married Model (n=823)

Dependent Variable: Left Teaching		
Variable:	**Marginal Effect**	**Standard Error**
Constant	-.53076	.00889
Male	.09964	.00424
Black	-.02757	.00659
Less Than 5 percent of Students Receive Reduced Lunch	.00886	.00390
20 to 50 percent of Students Receive Reduced Lunch	.02292	.00289
More than 50 percent of Students Receive Reduced Lunch	-.04452	.00299
Received Merit Pay Bonus of Less than $500 in period t-1	.16070	.01249
Received Merit Pay Bonus of Between $500 and $999 in period t-1	.07873	.00978
Received Merit Pay Bonus of Between $1000 and $2000 in period t-1	-.02017	.00911
Received Merit Pay Bonus of over $2000 in period t-1	-.10487	.00892
Member of a Union	-.09070	.00407
Family Income Less Than $35,000	.00757	.005244
Family Income Between $50.000 and $74,999	-.13700	.00384
Family Income Between $75,000 and $100,000	-.073845	.00429
Family Income Above $100,000	.79267	.00352
Percentage of Students With Limited English Proficiency	-.00197	.00121
Percentage of Students With Individual Education Plans	.000508	.0006
Possesses an MA Degree	.03514	.00414
Student-Teacher Ratio	.01243	.00038
Would Not be a Teacher Again	.31983	.01267
Number of Dependents	-.03815	.00143
Believe Student Behavior is a Problem At Their School	.29763	.00414
More than 50 percent Reduced Lunch and Merit Pay	.42928	.04104
Pseudo R^2	0.2405	

*All coefficients are statistically significant at the 1 percent level

Prediction Results for Married Attrition Model			
	Predicted Value		
Actual Value	0	1	Total
0	462 (56.1%)	104 (12.6%)	566 (68.8%)
1	123 (14.9%)	134 (16.3%)	257 (31.2%)
Total:	585 (71.1%)	238 (28.9%)	823 (100%)

Actual 1s and 0s Correctly Predicted: 72.418%

Table 3: Results From Probit Attrition Model: Single Subsample

Results of Single Model (n=542)

Dependent Variable: Left Teaching		
Variable:	Marginal Effect	Standard Error
Constant	-.28646	.01029
Male	.08771	.00591
Black	-.12230	.00882
Less Than 5 percent of Students Receive Reduced Lunch	.24217	.00561
20 to 50 percent of Students Receive Reduced Lunch	-.11301	.00415
More than 50 percent of Students Receive Reduced Lunch	-.13554	.00414
Received Merit Pay Bonus of Less than $500 in period t-1	.26027	.01310
Received Merit Pay Bonus of Between $500 and $999 in period t-1	.19620	.01017
Received Merit Pay Bonus of Between $1000 and $2000 in period t-1	-.20740	.01106
Received Merit Pay Bonus of over $2000 in period t-1	.13540	.02116
Member of a Union	-.26001	.00055
Total Teaching Salary Less than $30,000	.11813	.00500
Total Teaching Salary Between $40.000 and $49,999	.02899	.00875
Total Teaching Salary above $50,000	.56782	.01164
Percentage of Students With Limited English Proficiency	-.00102	.00012
Percentage of Students With Individual Education Plans	-.00084	.00007
Possesses an MA Degree	.2213	.05778
Student-Teacher Ratio	.00615	.00050
Would Not be a Teacher Again	.2596	.0122
Believe Student Behavior is a Problem At Their School	.42200	.00374
More than 50 percent Reduced Lunch and Merit Pay	-.30237	.00425
Pseudo R^2	.20806	

*All coefficients are statistically significant at the 1 percent level

Prediction Results for Single Attrition Model			
	Predicted Value		
Actual Value	0	1	Total
0	248 (45.8%)	37 (6.8%)	285 (52.6%)
1	165 (30.4%)	92 (17.0%)	257 (47.4%)
Total:	413 (76.2%)	129 (23.8%)	542 (100%)

Actual 1s and 0s Correctly Predicted: 62.731%

Table 4: Results from Movement Probit Model: Married Subsample

Results of Married Model (n=566)

Dependent Variable: Moved to Another School		
Variable:	Marginal Effect	Standard Error
Constant	.05466	.01058
Male	-.03593	.00546
Black	-.30108	.00546
Less Than 5 percent of Students Receive Reduced Lunch	-.01913	.00488
20 to 50 percent of Students Receive Reduced Lunch	-.04338	.00368
More than 50 percent of Students Receive Reduced Lunch	.07193	.00350
Received Merit Pay Bonus of Less than $500 in period t-1	.12077	.01545
Received Merit Pay Bonus of Between $500 and $999 in period t-1	.03287	.01223
Received Merit Pay Bonus of Between $1000 and $2000 in period t-1	-.09342	.01079
Received Merit Pay Bonus of over $2000 in period t-1	.22461	.01451
Member of a Union	-.15155	.00500
Family Income Between $20,000 and $35,000	.04560	.00720
Family Income Between $50.000 and $74,999	.10630	.00395
Family Income Between $75,000 and $100,000*	.00771	.00637
Family Income Above $100,000	.62680	.00209
Percentage of Students With Limited English Proficiency	.00144	.00011
Percentage of Students With Individual Education Plans	.00115	.00008
Possesses an MA Degree	.12732	.00492
Student-Teacher Ratio	-.00928	.00055
Would Not be a Teacher Again	.24337	.01688
Number of Dependents	-.03853	.00148
Little Influence on Policy	-.01317	.00441
Little Collaboration with other Teachers	.11813	.00441
Pseudo R^2	.08053	

*Not significant at 1 percent level

Prediction Results for Married Movement Model			
	Predicted Value		
Actual Value	0	1	Total
0	236 (41.7%)	42(7.4%)	278(49.1%)
1	221 (39.0%)	67(11.8%)	288 (50.9%)
Total:	457 (80.7%)	109 (19.3%)	566 (100%)

Actual 1s and 0s Correctly Predicted: 53.534%

Table 5: Results of Movement Probit Model: Single Subsample

SS
Results of Single Model (n=285)

Dependent Variable: Moved to Another School		
Variable:	**Marginal Effect**	**Standard Error**
Constant	-.27932	.01261
Male	-.00200	.00682
Black	-.01879	.01167
Less Than 5 percent of Students Receive Reduced Lunch	-.01621	.00668
20 to 50 percent of Students Receive Reduced Lunch*	-.00377	.00454
More than 50 percent of Students Receive Reduced Lunch	.02168	.004621
Received Merit Pay Bonus of Less than $500 in period t-1	-.13353	.01362
Received Merit Pay Bonus of Between $500 and $999 in period t-1	.26454	.02028
Received Merit Pay Bonus of Between $1000 and $2000 in period t-1	.32724	.01605
Received Merit Pay Bonus of over $2000 in period t-1	.78258	.00263
Member of a Union	.13200	.00587
Total Teaching Salary Less than $30,000	.01430	.00569
Total Teaching Salary Between $40.000 and $49,999	-.08401	.00853
Total Teaching Salary above $50,000	.06084	.01240
Percentage of Students With Limited English Proficiency	-.00005	.00001
Percentage of Students With Individual Education Plans	.00185	.00008
Possesses an MA Degree	.07479	.00768
Student-Teacher Ratio*	-.00140	.00059
Would Not be a Teacher Again	.37687	.02185
More than 50 percent Reduced Lunch and Merit Pay Over $2000	-.30738	.00314
More than 50 percent Reduced Lunch and Merit Pay Between $1000 and $2000	.46748	.04157
More than 50 percent Reduced Lunch and Merit Pay Between $500 and $999	-.29221	.00302
Little Influence on Policy	.11229	.00554
Little Collaboration with other Teachers	.16767	.00584
Pseudo R^2	0.16767	-

*Not statistically significant at 1 percent level

Prediction Results for Single Movement Model			
	Predicted Value		
Actual Value	0	1	Total
0	137 (48.1%)	15 (5.3%)	152 (53.3%)
1	106 (37.2%)	27 (9.5%)	133(46.7%)
Total:	243 (85.3%)	42 (14.7%)	285 (100%)

Actual 1s and 0s Correctly Predicted: 57.544%