Chapter 3: Smaller Classes, Lower Salaries? The Effects of Class Size on Teacher Labor Markets

Eric Hanushek and Javier Luque
Hoover Institution
Stanford University

In recent years, the effects of changes in class size have been the focus of intense discussions among education policymakers. Much of the debate has centered on the relationship between class size and student performance, as researchers attempt to study the effects of reducing class sizes and to interpret the results from a policy perspective.

Though controversy about the costs and effects of change remains, the range of differences is narrowing and the options are becoming clearer. [1] However, the existing research generally neglects the overall effects of smaller class sizes on teachers. Current literature tends to concentrate on teaching techniques, such as classroom management and time on-task, to which achievement gains can largely be attributed. But how does class size affect overall teacher satisfaction? Do teachers simply enjoy their jobs more when their classes are smaller? If so, how does that affect teacher salaries and the labor market?

Most experts agree that smaller classes reduce the teacher's workload. Fewer students means fewer papers to correct, fewer tests to grade, and fewer discipline problems. Smaller classes indeed might provide teachers with increased personal satisfaction in their jobs. There is some survey evidence that says teachers prefer smaller class sizes, though it is not the most important issue for the majority of teachers.[2]

To understand the policy implications of teachers' preferences about the teaching environment in general and class sizes in particular, we must explore which characteristics teachers value in their workplace and how much compensation they require to accept something different. Preferences and compensation directly affect the decision to become a teacher and, once in the teaching profession, to change jobs among schools and school districts or to leave the teaching profession altogether. For example, many people have suggested that teachers move from inner-city schools to suburban settings because they prefer the location, achievement levels, or economic background of students in those areas. But class size also is a characteristic that might affect a teacher's level of satisfaction with the workplace.

Some research has been done on class-size policy as it relates to employment (e.g., Hanushek, Kain, & Rivkin, 1999), but little effort has been made to measure its importance—a measurement that could be critical for policymakers. For example, if it is found that teachers are willing to accept lower salaries in exchange for smaller classes and better working conditions, this information could reduce significantly the costs of lowering class sizes.[3] On the other hand, if research shows a weak relationship between class size/working conditions and salary demands, then these factors would not enter into the policy debate.

This chapter explores the ways in which class size, among other working conditions, affects the teacher's salary. To produce accurate cost estimates for policy changes, it is essential to

understand the effects of working conditions on the salaries and retention of teachers. This analysis will identify the magnitude of these effects.

The Study: How Does Class Size Affect Teacher Salaries and Job Turnover?

This study found that an increase of one student generally increases teacher salaries between 0.9 and 1.2 percent.[4] This effect is found to be statistically significant in *some*, but not all, of the empirical specifications and for some, but not all, points on the salary schedule. At the same time, other factors have a stronger influence on district salaries. For example, we find that teachers with a higher number of minority students within their school district are compensated positively.

The available data allow investigation into how effects might differ across relevant policy dimensions. Specifically, one might think that the reactions to differences in class size are strongest in urban areas, where the alternative employment opportunities for teachers are larger. However, the results show stronger effects of class size on teachers' salaries in suburban and rural areas.

The way in which teacher salaries adjust to local wages seems muted, though the adjustment is stronger as we move up in the teacher salary schedule. A 10-percent increase in local salaries for people with bachelor's or master's degrees is associated with 1.6- to 2.1-percent increases in teacher salaries.

The data also allow us to observe other dimensions of the relationship between teacher labor market decisions and school environment. Specifically, labor market determinants of teacher turnover and the tendency of districts to have difficulties finding qualified teachers were examined.

Teacher turnover at least partially reflects the degree of satisfaction of teachers with their jobs and work environment. Low turnover should reflect teachers' satisfaction with their decisions to teach in a particular school against opportunities in other schools, or in the nonteacher labor market. We find that higher teacher salaries, lower minority enrollment, and lower outside salaries are associated with lower teacher turnover. One intriguing feature of the data is that bigger class sizes *do not* prompt higher turnover.

The study also sheds some light on districts that reported problems hiring new teachers. These problems are reflected in the districts' responses to vacant or temporarily filled teaching positions and whether they had to close teaching positions due to difficulties in finding suitable personnel. The presence of bigger class sizes and higher concentrations of minority students are good predictors of these difficulties. However, teacher salaries do not seem to have a strong predictive power. On the other hand, larger class sizes do seem to have some impact on making hiring more difficult. But if a district has difficulty hiring, it might need to have larger class sizes simply because it has too few teachers. The question remains, though: which causes which?

The Study's Approach and Methodology

The study followed a process of standard economic analysis of a labor market. In simplest theoretical terms, workers choose jobs from a number of opportunities available to them. A worker generally will choose a job that gives the most satisfaction, even if it is not the highest paying job. In comparing jobs, workers consider not just compensation, but factors such as working conditions, satisfaction of the work, friends/coworkers, and workplace location.

The implication of this analysis is simple: If two teaching jobs have equal pay, the same general location, and other factors, teachers will choose the job with the better working conditions.

In other words, if a job has inferior, less desirable working conditions, such as dangerous or unpleasant surroundings, the employer must pay a premium to attract workers. Thus, nominal salaries will be higher. This framework, which labor economics literature refers to as the theory of compensating differentials, is applied directly to salary decisions made by teachers with respect to class size and other school attributes.

Of course, this assumes that labor markets involve the free flow of individuals, so that the relationships can be interpreted as the marginal effect of salaries on various factors. Significant rigidities in labor markets—caused, for example, by geographic constraints on teachers or union restrictions—could distort the wage impact. Two things are important for this study, however. First, although imperfections in the labor market might affect the interpretation of differences, these are the conditions faced by districts. Second, as shown below, there is significant turnover of teachers across the country and across different geographical areas. Thus, there is an obvious case for clear labor market adjustments.

To analyze the relationship between teacher salaries and job satisfaction, we use the same principles employed by the Bureau of Labor Statistics in the development of the consumer price index. The basic concept is to regress the costs of an item based on its characteristics in order to determine and understand how consumers value different features. The concept can be applied to labor markets by regressing individual salaries based on the worker's characteristics plus the characteristics of the job.

These methods also have been proposed as one way of dealing with the adjustment of teacher salaries for inflation (Hanushek, 1999; Goldhaber, 1999). Although they are not easily applied to disentangle overall salary inflation, they can provide direct evidence on district-to-district effects of different working conditions.

In this study, each school comprises a set of characteristics for which we must determine a value according to teacher preferences. Characteristics include the following:

- Salary schedule
- Fringe benefits
- Location
- Physical attributes of the school and surroundings
- Student demographics

- Expectations/teaching load
- Number of classes to be taught
- Length of the school day
- Class size

In the first stage of the analysis, we focus on how teachers are compensated for changes in their teaching environment. For example, how much must a teacher be compensated when he or she is asked to teach larger classes?

This approach presents an inherent challenge. It is difficult to account adequately for other job characteristics and for differences in the skills of individuals. In many occupations, the more desirable, attractive jobs are often occupied by people with higher skills. Since highly skilled workers generally are paid more, an inaccurate conclusion could be drawn suggesting that these desirable jobs pay higher wages. Therefore, it is imperative to attain an accurate estimate of other attributes that affect earnings in order to obtain estimates of any compensating differentials.

We view the issue as a district characteristic, in part because teachers seldom are hired for specific schools and seldom expect to spend their career in a single school. On the other hand, this is clearly a simplification, because most teachers know the schools where they are likely to teach and where they are willing to teach. Unfortunately, given our approach and the structure of available data, we are unable to go into the details of any district.

Data

To complete this study, teacher salary data was collected, along with information about school and teacher attributes and teacher recruitment and retention.

The School and Staffing Survey (SASS), conducted by the National Center for Education Statistics (NCES), includes a representative sampling of U.S. schools, both public and private. Data were gathered by interviewing school officials, teachers, and district administrators. SASS databases provide excellent information on district, school, and teacher characteristics and allow the investigation of the relationship between teachers and schools over time.

This study used the 1993-94 SASS, which provides data on 4,993 school districts.[5] Relevant information from the survey included the following:

- Geographic location
- Socioeconomic status of the area
- Grade levels offered in each school
- Student enrollment
- Minority student enrollment
- Number of students eligible for free or reduced-price lunch
- Number of full-time equivalent (FTE) teachers and support personnel
- Number of minority teachers
- Wage schedule

The SASS also asked teachers about the number of students and classes they were teaching. We aggregate this information to determine an average class size in each district.

It must be stated that teachers are not isolated from the general labor market—they have employment opportunities outside of the school. These employment opportunities will vary by region. Some areas boast higher wages, while others have better overall opportunities. Information about local labor market conditions was used to allow for variations in the conditions facing individual school districts. To do so, census data were used to construct a wage index and an unemployment index for each metropolitan statistical area (MSA). For school districts not aligned with a specific MSA, information corresponding to labor market conditions in non-MSA locations in each state was used.

It is no surprise that the general pattern revealed by the data is that teacher salaries are higher on average in urban areas than in rural areas. (See Table 1.) The relative salaries in central cities versus the suburban rings of metropolitan areas are generally close across all levels of teacher experience and education, although teachers in central cities tend to have slightly higher average salaries than do those in suburban districts.

Table 1
Basic Descriptive Statistics by Region and Geographic Location

	Northeast Central City	Suburban	Outside MSA	Midwest Central City	Suburban	Outside MSA	South Central City	Suburban	Outside MSA	West Central City	Suburban	Outside MSA
Salaries by Category												
Bachelor's Degree and No Experience	26,278	26,608	22,057	23,066	22,697	19,853	21,918	21,432	20,446	23,758.88	23,022	21,161
Master's Degree and No Experience	28,316	28,937	23,891	25,361	25,115	21,929	23,324	23,075	22,068	25,912	25,561	23,688
Master's Degree + 30 Credits and No Experience	29,835	30,775	25,254	27,108	26,775	23,307	24,058	24,088	22,988	27,506	26,775	25,059
Master's Degree and 20 Years of Experience	46,686	49,143	38,364	41,920	42,203	32,484	34,738	33,128	30,633	40,282	39,920	36,056
Highest Salary in District	51,311	54,377	41,944	47,042	46,034	34,869	38,831	32,789	33,955	46,219	45,452	39,509
Other Characteristics												
Class Size	21.019	20.42	18.63	22.03	22.524	19.65	21.88	21.85	20.247	26.42	25.85	19.93
% Minority	39.37	13.36	3.36	28.97	11.157	7.57	52.98	26.17	31.32	47.7	33.65	26.33
% Free or	49.78	25.41	39.83	41.66	29.317	49.96	52.39	44.64	60.67	50.53	38.62	50.89

Reduced-Price Lunch												
Area Wage With Bachelor's or Master's Degree	24,873	25,646	19,103	21,796	23,614	17,279	21,611	22,393	18,638	23,376	23,173	17,456
Unemployment Rate	0.021	0.023	0.029	0.022	0.020	0.025	0.023	0.022	0.023	0.029	0.027	0.043
Turnover Rate	0.051	0.068	0.070	0.054	0.067	0.078	0.105	0.099	0.085	0.076	0.090	0.10
Districts With Hiring Difficulties	25	101	34	46	62	87	60	119	199	45	117	89

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
West: Alaska, Arizona, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, and Washington.

The range of average class sizes across regions tells a slightly different story. In the rural Northeast, classes average fewer than 19 students per class, while classes in the central cities of the West average more than 26 students. Again, the differences between rural and urban districts are larger than those between central cities and suburban districts.

The characteristics of student bodies also differ significantly by region and geographic location. As is well known, central city districts typically have larger minority populations than either suburban or rural districts. Eligibility for free and reduced-price lunch, however, does not follow the same pattern. Rural areas are generally identified as having higher concentrations of students eligible for free and reduced-price lunches, although a portion of that might reflect an inaccurate measurement of poverty rates by geographic location.

Finally, average wages of those in competing industries vary by geographic area and region. These wages, calculated as the average earnings of individuals with a bachelor's degree in each metropolitan area or rural areas in a state, indicate how competitive wages vary. The earning opportunities tend to be highest in the Northeast and lowest in the South.

In the second stage of our analysis, we constructed teacher turnover ratios. These ratios correspond to the number of newly hired full-time equivalent (FTE) teachers, over the number of total FTE teachers in the district. In Table 1, we present the mean of these variables according to region and geographic location. The turnover rate ranges from 5 percent in the central city districts of the Northeast to 10 percent in the rural West. (The level of teacher mobility suggests enough movement for wages to adjust to varying supplies of teachers.)

In the final part of the analysis, we measured the difficulty of hiring suitable teachers. A district that had to reduce the number of FTE positions because of a lack of suitable candidates or a district that had vacant or temporarily filled positions was considered to have difficulties in hiring suitable teachers. In Table 1, we present the number of districts reporting these problems by region and geographic location. Such hiring problems are consistently more prevalent in central cities and in the fast-growing districts of the West.

Empirical Strategy

Teacher compensation

Though the primary objective was to determine how teacher compensation adjusts for varying class sizesit is necessary consider other factors that affect and a suitable formula calculating salaries.

The primary set of factors considered were the following:

- Average class size in the district (CS)
- Average number of classes taught (NUMCL)
- Time spent at school (TIME)
- Minority population inside the district (PMIN)
- Proportion of students eligible for free or reduced-price lunch (PLUNCH)

- Average wage of workers with bachelor's degrees, specific to MSA (WAGE)
- Unemployment among workers with bachelor's degrees, specific to MSA (UNEM)

Additionally, we control for the specific state and whether or not the district is located in an MSA.

We begin by using a basic salary determination model that shows how these factors influence teacher salaries. (See Figure 1.)

Figure 1
Salary Determination Equation

$$salary = a_0 + a_1CS + a_2NUMCL + a_3TIME + a_4PMIN + a_5PLUNCH + a_6wage + a_7UNEM + a_8STATE + a_9METRO + e_1$$

Notes on the equation:

The error term in the equation, e, indicates unexplained differences in salaries.

Lower case for the variable corresponding to teacher salary (*salary*) and average local income (*wage*) indicate that they have been transformed into logarithms.

The coefficients to be estimated ($a_0, \ldots a_9$) indicate how teacher salaries adjust to each of the explanatory variables. Specifically, the coefficient representing class size (a_1) is the increase in teachers' salary associated with an increase in one student in the class size. This interpretation—the percentage increase in salaries from a one-unit change in the variable—applies to all variables except area wages. The coefficient on wages indicates how percentage changes in area wages translate in percentage changes in salary.

In this salary determination model, class size, number of classes, and time spent at school are all included to measure characteristics of the job structure that teachers might value.

Other work has shown that teachers are sensitive to the demographic characteristics of the students they teach. For this reason, we include both a measure of socioeconomic status (eligibility for free or reduced-price lunch) and the minority composition of the school.

The wage for other college-educated workers in the area serves two purposes. First, it measures the job opportunities in the area, and second, it indicates whether the area is a high- or low-wage area that would partially reflect cost-of-living differences.

The unemployment rate also is designed to indicate the underlying employment structure in the area.

The geographic measures are meant to incorporate the amount of potential mobility, in particular, the limitations that might occur in rural areas.

Finally, individual state differences in teacher certification, regulations, and the like are incorporated as a fixed state factor.

Flies in the Ointment: Alternative Models

Estimating these relationships requires some care, and alternative approaches were pursued. The basic estimation employs standard regression techniques but corrects for any differences across states in the variance of the errors.[6] Note, however, that in order to obtain unbiased estimators of the different influences, we have to assume no relationship between the error term (e) and the other variables on the right-hand side of equation (1).

This assumption could be flawed in a variety of ways. Perhaps the simplest would arise from important factors being left out of the modeling. If important factors are not considered, the estimate generally misstates the true relationship.[7] An alternative source of problems can arise through the way in which the class sizes are set inside the district. For example, there could be general preferences toward education that imply both smaller class sizes and higher teacher salaries, leading to an artificial relationship between the two.

To overcome these possible problems, we directly consider the possibility that class sizes are determined simultaneously with teacher salaries. We estimate the system in Figure 2.

Figure 2
An Alternative Salary Determination System

$$salary = a_0 + a_1 CS + a_2 NUMCL + a_3 TIME + a_4 PMIN + a_5 PLUNCH + a_6 wage + a_7 UNEM + a_8 STATE + a_9 METRO + e_1$$

$$CS = b_0 + b_1 SALARY + b_2 KCS + b_3 POPGROW + b_4 STATE + b_5 METRO + e_2$$

Note:

POPGROW is the growth in student population described above, and KCS is the average class size for kindergartens in the district.[8] These two equations provide the basis for a different way to estimate the coefficient on class size, the parameter of interest.

In order to estimate the separate equations in Figure 2, it is necessary to find factors that affect class size but have no effect on teacher salaries. These factors, called instruments in the statistical literature, allow us to distinguish causation from the observed correlation. We use two such possible factors.

The first, POPGROW, is the rate of student population growth, measured as the ratio of the number of students in Grade 12 to those in Grade 1 within the district. The faster the growth rate in students, the more teachers a district will need, and the harder for districts to keep constant teacher-student ratios. If there is a time lag between student population growth and teacher hiring, this will constitute an additional valid instrument.

The second instrument, KCS, is the class size of kindergarten classes in the district. The importance of small classes in the early years has been cited in many studies. This instrument would be valid if kindergarten class size—because of its independently perceived educational value—did not directly enter into the district's perceived financial constraints, or if it did so but had a smaller effect than on regular classes.

Salary Determination Results

The basic results of the salary determination estimation, using the alternative approaches described in Figures 1 and 2, are summarized in Table 2. For discussion purposes, we concentrate on Model 3. These allow for simultaneous determination of class size and salaries and are estimated with the full set of instruments for class size (POPGROW and KCS). These estimates are the most straightforward of the set.

In Table 2, teachers are divided by their place on the salary schedule as noted by degree level and years of teaching experience. There is some variation in the estimated effects of class size on salary across the different teacher categories, but the effect on entry teachers is instructive. By the first set of instrumental variable estimates, increasing class size by one student is associated with a 0.9-percent increase in salaries for entry teachers. This estimate is significant at the 1-percent level, indicating considerable confidence that it is not 0. This estimate indicates that there would be some salary offset to any class-size reductions. The largest relationship between salary and class size actually occurs for teachers with the highest salaries in the district. The estimate for this group is twice as large as that for new teachers.

The results tend to be somewhat sensitive to the precise estimation strategy, and many of the separate estimates are not significantly different from 0. As a general statement, however, there tends to be a small positive effect on salary as a result of larger classes.

Teacher Turnover

In addition to the consideration of wage determination, we must look at staffing issues and consider how labor market and school factors might affect those issues. We considered how factors similar to those that affect salaries also affect teacher turnover. Again, we use an equation to predict the district's teacher turnover ratios. (See Figure 3.)

Table 2
Estimated Effect of Selected Variables by Teacher Characteristics 1/

	Model 1 2/		Model 2 3/		Model 3 4/	
Variable	**Coefficient**	**P>|t|**	**Coefficient**	**P>|t|**	**Coefficient**	**P>|t|**
Bachelor's Degree and No Experience						
Class Size	0.001166	**	0.00618		0.008829	***
Local Wage	0.1898	***	0.16599	***	0.15912	***
Minorities	0.000573	***	0.0005458	***	0.000516	***
Free Lunch	-0.00026	***	-0.0002494		-0.00024	***
Master's Degree and No Experience						
Class Size	0.0016	***	-0.0013643		0.01098	***
Local Wage	0.2057	***	0.20158	***	0.16789	***
Minorities	0.000638	***	0.000664	***	0.000542	***
Free Lunch	-0.00028	***	-0.0003		-0.00025	***
Master's Degree + 30 Credits and No Experience						
Class Size	0.00196	***	0.00216		0.011666	***
Local Wage	0.20797	***	0.19833	***	0.17465	**
Minorities	0.000766	***	0.0006785	***	0.000578	***
Free Lunch	-0.00035	***	-0.0003863	*	-0.00033	***
Master's Degree and 20 Years of Experience						
Class Size	0.00303	***	0.0680947		0.012141	**
Local Wage	0.2436	***	0.0289178		0.18218	**
Minorities	0.000718	***	0.0000898		0.000625	***
Free Lunch	-0.00047	***	-0.0000814		-0.00042	***

1/ Other independent variables were the number of classes taught, hours spent at school, unemployment rate, metropolitan status and state.
2/ OLS estimation corrected by heteroscedasticity at the state level
3/ Three-stage estimation of system presented in text. Class size does not include preschool teacher ratio.
4/ Three-stage estimation of system presented in text. Class size includes preschool teacher ratio.
*, **, *** denote significance levels smaller than the 10%, 5%, or 1%.

Figure 3
Teacher Turnover Determination Equation

$$TURNOVER = a_0 + a_1CS + a_2INCG + a_3SALARY + a_4WAGE + a_5QUA + a_6PMIN + a_7PLUNCH + a_8WAGE + a_9UNEM + a_{10}STATE + a_{11}METRO + e_1$$

Among the determinants of turnover are the district's class size, the expected income growth (INCG), the teacher salary, the local wage, a measure of the degree of certification inside the district (QUA),[9] the unemployment index, and indicators of state and metropolitan areas.

Prediction of the district's difficulties in recruiting teachers was done using a dichotomous variable model, where the dependent variable (PROB) could only be one of two values: yes if the district reported problems, and no. The model to be estimated is:

$$PROB = a_0 + a_1CS + a_2INCG + a_3SALARY + a_4WAGE + a_5QUA + a_6PMIN + a_7PLUNCH + a_8UNEM + a_9STATE + a_{10}METRO + e_1$$

As determinants of hiring problems, we include the class size, the expected income growth (INCG), the teacher salary, the local wage, a measurement of the degree of certification inside the district (QUA), the unemployment index, and indicators of state and metropolitan areas.

Interpretation

Teacher Compensation

A reduction in class size tends to be very expensive. For example, reducing class size from 20 to 19 students is a reduction of 5 percent. If no other inputs changed, it would be appropriate to compare the increased demand for teachers and the reduction in salaries—suggesting that the salary offset from class-size reduction could cover perhaps 10 to 20 percent of the added costs. It seems unlikely that no other costs would rise with smaller classes. In fact, a common estimate is that total per-pupil expenditures will rise proportionately with a reduction in class size. If this were the case and if only teacher salaries were affected by lower class size, the percentage of salary offset would be cut roughly in half.

The effect of other factors on teacher salary, such as the concentration of minorities, was found to be significant. An increase of a single percentage point in the minority population of a school district was directly related to a salary increase of 0.05 percent for teachers with bachelor's degrees and no experience.

This implies that one district with 50 percent more minority students will exhibit higher teacher salaries by almost 3 percent.[10] At the same time, salaries do not appear to rise with more disadvantaged students. In fact, it is just the opposite. This juxtaposition of the salary effects of minority and of disadvantaged students is puzzling, because previous analysis (e.g., Hanushek, Kain, & Rivkin, 1998) suggest that teacher preferences and mobility related to these populations parallel each other.

The elasticity between teacher salaries and local salaries was found to be 0.16. This implies a relatively small adjustment of teacher salaries to local market conditions. For example, 10 percent higher average salaries among college graduates in an area would push up teacher salaries by only 1.6 percent.

It is not clear how to interpret these estimates. It could be that schools tend to be rather insulated from local labor market conditions, perhaps because people who want to teach are relatively insensitive to salary. Alternatively, schools in expensive markets simply might tend to hire lower-quality teachers.

By disaggregating the data by region, we can investigate the source of the positive salary effects of class size. The South and the Midwest show the most significant effects—1.5- and 0.8-percent increase in teacher salary per additional student, respectively. These estimates are balanced against positive, but statistically insignificant, effects in the remainder of the country.

Regarding the effects of class size on salaries in metropolitan areas, we find different coefficients on the class-size effect among metropolitan areas and the surrounding areas. We observe a larger effect in suburban areas than in central cities. The effect in suburban areas is significant. Rural areas also present a positive effect, but smaller than that in suburban areas.

Teacher Turnover and Hiring Problems

Salaries are not the only place where labor market factors and working conditions wield their influence. They can also affect the ability of districts to hire and retain teachers.

An analysis of teacher turnover in districts shows, not surprisingly, that higher teacher salaries decrease the turnover ratio. At the same time, higher local salaries increase turnover rates, but by a lower quantitative amount. This implies that these labor markets are not separated, but it also reinforces the previous finding: Teachers are not too sensitive to variations in outside wages.

A higher percentage of minorities in the student population is also associated with higher turnover.

Higher ratios of certified teachers are related to less turnover, although the exact explanation for this is unclear.

The only surprising part of the models is that class size has a negative impact on turnover. In other words, it appears that turnover is reduced when a district has larger class sizes. This

perhaps reflects the fact that teachers choosing districts with larger average class sizes are happy with the wage differential they receive and are, on average, not dissatisfied.

The final aspect of the analysis is to consider what causes districts to have difficulty in hiring teachers. The basic results suggest that difficulties in finding teachers are related to larger class sizes.[11] Nonetheless, the interpretation is difficult. If a district cannot find teachers for its vacancies, class sizes could rise because there are insufficient teachers. In other words, the direction of causation is in doubt.

Within these models, it is difficult to sort out the separate effects. Districts with higher minority student populations have more difficulties hiring teachers, but salaries do not seem to play a major role.

Conclusion

Class-size policies have many facets—from educational to political. In addition, however, there are a series of fiscal implications. This work concentrates on just one of these—whether differences in class size affect the appeal of districts sufficiently to have impacts on the labor markets that the districts face. This aspect ignores a number of other important issues, including the direct costs of hiring more teachers to accommodate a smaller class size and the necessity of having additional classroom space. It is nonetheless important, because teacher quality is a key ingredient to better performance of schools.

Historically, little has been known about the salary or hiring implications of reduced class sizes. Some have even speculated that teachers so value small classes that the reduced salaries they would be willing to accept would offset the costs of class-size reduction. Nonetheless, it is clear that some salary effects could help recoup some of the additional costs.

This analysis suggests that class size has a small but noticeable effect on the salaries paid by school districts. All things being equal, a decrease of class size by one student is associated with teachers' salaries that are 1 to 2 percent lower. Thus, for example, a class-size reduction policy of three to four students across the board could lower the necessary payments for teacher salaries by some 5 percent. If teacher salaries are half of the cost of a district's operations, this could amount to a 10- to 15-percent offset to the class-size reduction policy.[12] This study, however, suggests that this effect may differ across regions of the country and across geographic locations within states (i.e., central city, urban, suburban, and rural). The latter estimates are, however, prone to considerable uncertainty.

This analysis also has provided insight into a variety of other aspects of teacher salaries and teacher labor markets. One of the most interesting findings is that teacher salaries do not move very closely with the salaries of other college graduates in an area. If other salaries are 10 percent above the national average in an area, teacher salaries tend to be only about 1.6 percent higher than teacher salaries elsewhere. What is unknown is whether the quality of teachers also adjusts with these different opportunities.

In addition, we have found that characteristics of the student body also affect salaries. In particular, it appears that teachers require higher salaries to teach in districts with higher concentrations of minority students. On the other hand, just the opposite appears to be true for disadvantaged students. Thus, it is difficult to make consistent conclusions about the preferences of teachers for specific types of students.

The turnover of a district's teachers, which we take to be an indication of the employment appeal of a district (after allowing for population growth), has the expected relationship with salary. Higher teacher salaries reduce turnover, while higher outside salaries in the area increase turnover. Again, however, these are not as precisely related as one might expect. Turnover is much more dependent upon district salaries than on other market opportunities.

This study is best viewed as a preliminary investigation of factors of the teacher labor market. Most notably, we have no measures of the quality of teachers, with perhaps the exception of the certification rate. We can observe flows of teachers into and out of districts and we can observe the salaries associated with districts' filling their teaching requirements, but we cannot observe the effects on student outcomes. Any full policy consideration should certainly pursue the issue of quality results, but this study did not attempt to do so.

Endnotes

1. Some sense of the range of discussion and the current state of the debate can be found in a special issue of *Educational Evaluation and Policy Analysis*, Summer 1999.

2. For example, the recent Public Agenda survey, Farkas et al. (2000).

3. Indeed, some people have argued that these effects are large enough to justify reduced class size, even if the effect of class size on student performance is zero. These arguments in the past have not been based on any evidence, however.

4. The estimates depend on the level on the salary schedule considered. See Table 1.

5. The SASS was conducted by the NCES during the years 1987-88, 1990-1991 and 1993-1994.

6. Because different mechanisms inside the states can affect the dispersion in educational expenditures, we correct for heteroscedasticity. States not only control an important part of educational funding but also face differing court and legislative pressures to achieve local revenue equalization.

7. Intuitively, the estimated coefficients are biased because the measured factors will partially reflect unmeasured influences that are correlated with variables in the estimation. The degree of bias is related to how important the omitted factors are and how closely correlated these omitted factors are with the included factors.

8. This corresponds to Model 3 in Table 3. A previous model with population growth as the sole instrument for class size is presented as Model 2.

9. It has been argued that certification represents a sunk cost for teachers.

10. Results were similar for the other salary schedules.

11. Because the dependent variable is binary (there are either problems or not), these models are estimated using probit techniques. The coefficients can be evaluated as indicating the effect that each of the factors has on the probability of that the district faces problems.

12. The exact mechanism for achieving these savings is, of course, unclear, because it is doubtful that such a salary roll-back would be negotiated immediately. Instead it would probably reflect lower wage growth over a number of years.

References

Boe, E. E., Bobbitt, S. A., Cook, L. H., Whitener, S. D., Weber, A. L. (June 1996). *Predictors of retention, transfer, and attrition of special and general education teachers: Data from the 1989 teacher followup survey.* Working paper no. 96-12. National Center for Education Statistics: Washington, DC.

Educational Evaluation and Policy Analysis, 21(2).

Farkas, S., Johnson, J., Foleno, Y., Duffett, A., Foley, P. (2000). *A sense of calling: Who teachers and why? Public Agenda*: New York, NY.

Goldhaber, D. (June 1999). An alternative measure of inflation in teacher salaries, in William J. Fowler, Jr., Ed., *Selected Papers in School Finance*, 1997-99, pp. 33-54. National Center for Education Statistics: Washington, DC.

Hanushek, E.A. (June 1999). Adjusting for differences in the costs of educational inputs, in William J. Fowler, Jr., Ed., *Selected Papers in School Finance*, 1997-99, pp. 17-27. National Center for Education Statistics: Washington, DC.

Hanushek, E.A., Kain, J.F., & Rivkin, S.G. (April 1999). *Do higher salaries buy better teachers?* Working paper no. 7082. National Bureau of Economic Research: New York, NY.