Competition, Unions, and Educational Personnel Salaries

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Abstract

Competition-based education policies may have an important influence on the wages of the school personnel but the power of the unions may affect the policy outcomes substantially. I use a panel data set from Washington State's Office of Superintendent of Public Instruction to analyze the effects of competition on the salaries of teachers and principals. My findings show that principals have more bargaining power over their salaries than teachers. Moreover, I present that while the pattern of teacher salaries versus concentration in Washington is similar to that presented in the literature, the inflection point in Washington is at substantially lower levels of concentration — a finding which can be attributed to Washington's being a union state instead of a right-to-work-state.

Keywords: Education Finance; Education Policy; Public Policy; Unions; Competition; Salaries

1. Introduction

The effects of the competition-based school reform and public school teacher salaries are examined in the literature. If school districts act as typical oligopsonists while hiring teachers, then wages of the teachers may increase as the degree of competition among schools increase. Nevertheless, if school districts act as typical monopolist while supplying educational services, then wages of the teachers may decrease as the degree of competition among schools increase. The literature presents that as the level of competition increases, wages of most of the teachers increase, but the same change in the level of competition decreases the wages of teachers located in education markets with relatively high concentration ratios.

In this paper, I analyze this reasoning with different education personnel, with the intention to focus largely upon two groups of school personnel: teachers and principals. The influence of high levels of competition on wages of other education personnel would also be expected to be the same as or at least similar to that on teachers. On the other hand, the literature tells us that many different characteristics of teachers, such as their being the second-earner in the household, may differentiate the findings from that of other education personnel. My findings show that principals have more bargaining power over their salaries than teachers in Washington, that principals start getting positive returns from increasing concentration at lower levels of concentration than that of teachers. Moreover, I present that the pattern of teacher salaries versus concentration in Washington is similar to that in Texas, but the inflection point in Washington is at substantially lower levels of concentration—a finding which can be attributed to Washington's being a union state versus Texas's being a right-to-work-state. While the degree of competitive effect varies over a significant range when different measures of competition are employed, my general findings are

fairly robust to using different competition measures or utilizing different estimation procedures to deal with the endogeneity of the concentration measure.

2. Monopsony in Education Labor Markets

Economists have been aware of the situation that holders of factors of production, which are typically utilized in isolated locations, or in the production of public goods or services, can confront monopsony conditions. Bish and O'Donoghue (1970) point out that studies such as Samuelson (1954), Musgrave (1959), Sharp and Escarraz (1964), Williams (1966), Brainard and Dolbear (1967), Buchanan (1968), and Brennan (1969) report incorrect inferences because these studies analyze the socially optimum level of public good consumption by considering only the constant-cost situations, and overlook the problem of the possible monopsony setting. Shibata (1973) states that the potential monopsony situation can take place in the constant cost setting too, and he signifies the importance of evaluating both cases considering monopsony equilibrium.

Moreover, there are various studies in the literature investigating the monopsony effects specifically in certain job markets. Hurd (1973), Link and Landon (1975), Feldman and Scheffler (1982), Adamache and Sloan (1982), and Bruggink et al. (1985) highlight the monopsony power of the hospital industry and the level of employer concentration and the earnings of nurses. Additionally, Sullivan (1989) presents estimates of the inverse elasticity of supply of nursing services to a single hospital, which is a natural measure of the importance of monopsony power. He also examines the dependence of the inverse elasticity on several factors such as the duration of the pertinent time interval, whether or not the location of the hospital is in a big metropolitan region and the oligopsony setting taking into account the interactions among hospitals, and finds remarkably high monopsony effects in the nurse markets.

Borcherding (1971) draws attention to the fact that some of the military skills are solely exploited by the U.S. Government, and hence face a monopsony situation. Ransom (1993) presents that contrary to what could be expected for other jobs, higher seniority brings lower wages for university faculty because of the monopsonistic approach of the universities. Fleisher and Kniesner (1980), Boal (1995), Filer, Hamermesh and Rees (1996), Kaufman and Hotchkiss (2006), McConnell, Brue and MacPherson (2007), and Ehrenberg and Smith (2009) give the example of the isolated mining towns of the nineteenth and twentieth century as the classical labor monopsony. Since the coal mines are remotely located in rough territories, relocation is costly, and hence is the monopsony encountered by the coal miners.

Together with the nurses, some military personnel, the university faculty and the coal miners, teachers, as well, can find themselves in such an unfavorable situation of monopsony. Schools are teachers' workplace. However, other than the eleven percent[1] of the teachers on the national scale, who work in private schools, teachers are employed by the school districts and not by the individual schools. That is, the number of competitors for teachers is significantly less than the number of schools. As a result of this weak competition, monopsony or oligopsony can reign in several areas.

The first suggestion of monopsonistic teacher labor markets is presented in Landon and Baird (1971). Succeeding articles by Baird and Landon (1972), Lipsky and Drotning (1973), Thornton (1975), Gustman and Clement (1977), Cole (1977), and Holmes (1979) produced conflicting results about the connection between the monopsony power of the school districts and teacher wages.

[1] In 2009-2010, there are 437,414 private school teachers in the United States compared to about 3.2 million public school teachers.

Luizer and Thornton (1986) present indications of monopsonistic characteristics of the local teacher labor markets in Pennsylvania. Merrifield (1999) shows that in Texas, teachers in less competitive labor markets have relatively lower salaries. Similarly, Vedder and Hall (2000) explain that increased competition from private schools increases the public school teachers' wage rates in Ohio. Medcalfe and Thornton (2006), on the other hand, present that there is no evidence that teachers' salaries are less in less competitive labor markets in Georgia. Finally, using data from Texas school districts, Taylor (2010) finds that as the level of competition increases, wages of most of the teachers increase. Her original idea, however, is that while school districts may act like typical oligopsonists in teacher labor market, they also may have some monopoly power in the education services market, and if teachers are getting some of the rents due to this monopoly power, then increased competition in the education market may reduce teachers' pay. Rent-sharing by workers is examined by Blanchflower, Oswald and Sanfey (1996), Hildreth and Oswald (1997), and Black and Strahan (2001). Taylor (2010), nonetheless, presents the possibility of two different market structures—oligopsony in teacher labor markets and monopoly in education services market—playing opposite roles in determining the teacher earnings, that her findings also show that in relatively concentrated markets, increase in competition leads lower teacher wages.

In this study, I analyze the possibility of two different education market structures with other education personnel, with the intention to focus largely upon principals. The influence of high levels of competition on wages of other education personnel would also be expected to be the same as or at least similar to that on teachers. On the other hand, the literature tells us that many different characteristics of teachers, such as their being the second-earner in the household, may differentiate the findings from that of other education personnel. Moreover, another main point of this paper is that Washington is a union state and not a right-to-work state. Unions may constitute

a force working to balance the market power of the employers. Hence, the high level of unionization in Washington is likely determinant of wages. In fact, many studies in the literature such as Lemke (2004) or Kingdon and Teal (2010) find that there is about a 7-10% wage premium to public sector unions. On the other hand, some other studies such as Kleiner and Petree (1988) or Lovenheim (2009) find that unionization has no significant positive effect on wages. That is, the literature provides mixed findings about the effects of unions on wages. In this paper, I provide a comparison of a right-to-work state with a union state to provide a better understanding of the effects of unions on wages of employees in the education markets.

3. Models of Education Personnel Wage Determination

3.1. Wages in an Oligopsony Model

If the school districts act like oligopsonists, we can use Boal and Ransom (1997) Cournot model of oligopsony to model the educational labor markets. In this model, each school district would maximize their profits which can be written as

$$\max_{L_i} R_i(L_i) - w(L) \cdot L_i \tag{1}$$

where school districts choose their own level of employment, L_i, to maximize the difference between their revenue, R_i, and their cost, which is a function of the inverse labor supply function, $w(L)$, that the total employment by all public districts, L, determines a single market wage. The first-order condition for each school district is

$$\frac{\partial R_i}{\partial L_i} - \frac{\partial w(L)}{\partial L} \cdot L_i - w(L) = 0 \tag{2}$$

In equation (2), $\partial R_i/\partial L_i$ is the value of the marginal product of labor to the school district, or their marginal revenue product (MRP_i). We can rearrange equation (2) to get a measure of exploitation a la Arthur Pigou, that is

$$\mathrm{E}_i \equiv \frac{MRP_i - w}{w} = \frac{\partial w}{\partial L} \cdot \frac{L_i}{w} = \varepsilon^{-1} \cdot \frac{L_i}{L} \tag{3}$$

where ε is the wage elasticity of labor supply. Using equation (3), we can write an employment-weighted average of school district exploitations as

$$\mathrm{E} = \sum_{i=1}^{n} \frac{\mathrm{E}_i \cdot L_i}{L} = \varepsilon^{-1} \cdot \sum_{i=1}^{n} \left(\frac{L_i}{L}\right)^2 \tag{4}$$

Here, the sum of squared shares of employment is a Herfindahl index of market concentration, which we will denote as H. Then we can rewrite equation (4) to isolate w as

$$w = \sum_{i=1}^{n} \frac{MRP_i \cdot L_i}{L \cdot (\varepsilon^{-1} \cdot H + 1)} \tag{5}$$

As explained in Boal and Ransom (1997), the relationship between w and H is not static. That is, w and H are endogenous market outcomes determined by the number of school districts and their marginal revenue product. However, if we assume that total market demand and labor supply are fixed, then a negative relationship between w and H would suggest an oligopsony.

3.2. Wages in a Rent Sharing Model

If the public school districts act like oligopolist when providing the educational services, any rents generated by a district can be shared by that district's employees. Rent-sharing district employees can be modeled by using the model in Blanchflower, Oswald and Sanfey (1996). In their bargaining model, wages are determined in the following maximization problem

$$\max_{w,n} \phi \cdot \ln\{[u(w) - u(\bar{w})] \cdot L\} + (1 - \phi) \cdot \ln \pi \tag{6}$$

where $\phi \in [0,1]$ is the bargaining power of the employees of the district, $u(\cdot)$ is the utility function of each employee, w is the wage in the industry, $\bar{w}$ is the expected opportunity wages outside the industry, L is employment, and π is the profit. The first-order conditions are

$$w\text{: } \frac{\phi \cdot u'(w)}{[u(w) - u(\bar{w})] \cdot L} - \frac{(1 - \phi)}{\pi} = 0 \tag{7}$$

and

$$L\text{: } \frac{\phi}{L} + \frac{(1 - \phi) \cdot [R'(L) - w]}{\pi} = 0 \tag{8}$$

where $R(\cdot)$ is the revenue function. Equation (7) can be rewritten as

$$\frac{u(w) - u(\bar{w})}{u'(w)} = \frac{\phi \cdot \pi}{(1 - \phi) \cdot L} \tag{9}$$

Here, if we substitute $u(w) + (\bar{w} - w) \cdot u'(w)$ in place of $u(\bar{w})$, we would get

$$w \cong \bar{w} + \frac{\phi}{(1 - \phi)} \cdot \frac{\pi}{L} \tag{10}$$

where $\phi/(1 - \phi)$ is the relative bargaining strength of the employees and π/L is the rents per employee. We can assume that capital is quasi-fixed in the short-run. So we can write the rents per employee as

$$\frac{\pi}{L} = \sum_{i=1}^{n} (MRP_i - w^o) \cdot \frac{L_i}{L} = \overline{MRP} - w^o \tag{11}$$

where w^o is the going wage in the local economy, and $\overline{MRP}$ is the employment weighted average marginal revenue product. Since the expected opportunity wages outside the industry is a function of the going wage and unemployment in the local economy, U, we can write equation (10) as

$$w \cong c(w^o,\, U) + \frac{\phi}{(1-\phi)} \cdot (\overline{MRP} - w^o) \qquad (12)$$

In equation (12), wages increase as rents increase. In education markets, school district inefficiencies can be a source for economic rents. District inefficiency, in turn, is a function of competition in the education market, where efficiency increases with more competition. Therefore, we can expect that wages in a rent-sharing model is negatively related to the level of competition in the education services market.

3.3. Wages in a Union Model

According to the Schools and Staffing Survey (SASS) of National Center for Education Statistics, almost all of the public school teachers in Washington are in a union or employee's association. This is mainly because Washington is not a right-to-work state. A right-to-work law protects the employee rights to choose whether or not they want to become a member of a union or financially support it. For example, Taylor (2010) examines the determinants of teacher pay in Texas, which is a right-to-work state. However, when a state does not have a right-to-work law, a state of forced unionism may prevail in that state. The unions in a state may counteract the power of the oligopsonistic school districts.

As explained by Lovenheim (2009), the literature does not provide a complete theoretical model of education market unions. Hence, in theory, we do not know for sure how the effects of a teachers union on teacher pay or other educational variables would be. We can assume that the main goal of a union is to maximize the total welfare of its members, but then that would be a function of many variables such as the number of members with jobs, their hours of work, their level of benefits as well as their wage rates. Hence, basic models of unionization, which do not take into account the simultaneous collective bargaining over multiple outcomes, cannot give us

unique predictions. Empirical examination would give us an idea about the effects of unionization, but states such as Washington do not have variation in union membership. Therefore, in this study, I compare my results using Washington data with Taylor (2010) results to have an understanding of the impact of forced unions and right-to-work laws on teacher and principal wage rates.[2]

3.4. Reduced Form Models

Reduced form models of the wages in a classical oligopsonistic education market, and the wages in the rent-sharing model are very similar. Assuming that the labor supply in the education market is a function of expected opportunity wages, the reduced form of wages in an oligopsonistic education market can be written as

$$w_o = w_o(H, Z, w^o, U) \tag{13}$$

where Z includes the variables, which affect the marginal revenue of public school districts, such as the factors determining the education production technology or the local education demand. In the rent-sharing model, we can assume that the Herfindahl index of market concentration is one of the determinants of economic rents in the education market through school inefficiency, and write the reduced form of wages in a rent-sharing model as

$$w_r = w_r(H, Z, w^o, U, \phi) \tag{14}$$

There are two important differences between equations (13) and (14): First, the oligopsonistic model predicts that holding other variables constant, the effect of education market concentration on wages is negative. The same effect, however, is predicted to be positive in the rent-sharing model. The second difference between the equations is that the rent-sharing model

[2] The teachers unions and the principal union in Washington are separate organizations and these unions may have different levels of wage bargaining power. In fact, in this study, I present evidence that principals union has more bargaining power than teachers union in Washington.

includes an element, ϕ, which is the bargaining power of the employees. This term would be useful to capture the effects of unionization in the labor market. Nevertheless, if there is no variation in the unionization across the labor markets, this distinction between the equations would not be consequential. One possibility is that different employee types in the education markets may have different rates of unionization, which would cause a significant change in the overall findings. For example, if the level of public school teacher unionization is different than the level of public school administrator unionization, then if the effects of concentration index on the wages of teachers and administrators are different, that difference may partially be attributed to the different levels of unionization in those employee groups.

4. Data

The main data for this analysis come from the state of Washington Office of Superintendent of Public Instruction (OSPI) school personnel database, and National Center for Education Statistics' (NCES) Common Core of Data (CCD) and Private School Universe Survey (PSS). The U.S. Office of Management and Budget (OMB) identifies 21 Core Based Statistical Areas (CBSA) in the state of Washington.[3] These CBSAs include 12 metropolitan statistical areas and 9 micropolitan statistical areas. There are 39 counties in Washington, 13 of which do not belong to any CBSAs. The number of public schools in Washington is about 2000, which are operated by about 300 public school districts.[4] Moreover, the number of private schools in Washington is over 400. About 100 of these private schools are operated by three separate Dioceses or the Seventh-Day Adventist Church (SDA) in Washington. Hence, the number of private school districts is less

[3] Two of these CBSAs—Portland-Vancouver-Beaverton and Lewiston metropolitan statistical areas—cross state borders and include counties from either Oregon or Idaho. I exclude the counties in these cross-border CBSAs to avoid complications while calculating the concentration measures.
[4] The number of public school districts is more than 400 before 2001.

than the number of private schools if these school systems are counted as districts. In the 2003-2004 school year, the smallest public school district has 9 students, and the biggest has 46,636 students. The average public school district enrollment in the same year is 3460. The smallest private school district has 5 students and the biggest private school district has 20,366 students in the 2003-2004 school year. Mean private school enrollment in that school year is 549. Therefore, we can say that the range of education market structures is quite wide in Washington.

The unit of analysis in this study is the public school district personnel. OSPI collects and publishes detailed information on the earnings of public school district personnel and their characteristics. The OSPI personnel records indicate individuals' gender, ethnicity, major duty assignment, years of experience, percent of certified contracted time in major duty, public school district, and building assignment. The OSPI records present that there are about 30,000 elementary and secondary teachers, and about 1,700 principals and administrators in each school year between the 1997-1998 school year and the 2005-2006 school year in Washington.

An important part of my analysis is determining the education market area. The market needs to be clearly defined to measure H, Z, w^o, and U from equations (13) and (14). I follow the literature and assume that the education markets are the CBSAs identified by the OMB. Therefore, I treat each CBSA as a separate education market. In case an education personnel's location of work is not in any of these CBSAs, I assume that their school district's county is a distinct education market.

The H variable is the Herfindahl-Hirschman index of market concentration (HHI). In this study, the Herfindahl index of market concentration of an education market is the sum of squared enrollment shares of all of the public and private school districts in that education market. In Washington, the Herfindahl index of market concentration has a great variation across education

markets. For example, in the 2005-2006 school year, Seattle-Tacoma-Bellevue CBSA's Herfindahl index of market concentration is 0.033. On the other hand, in the same school year, Garfield County's Herfindahl index of market concentration is 1. Along with the HHI, in order to control for a possible nonlinear relationship between the HHI and the salaries, my model incorporates the square of the HHI.

The Z variable vector includes the characteristics of the education market which affects the marginal revenue product of the districts in that education market. The determinants of educational production technology and the local demand for education other than the market concentration can be in this vector of variables. The literature presents that the size of a school district is an important element in determining the educational production technology. Moreover, the relationship between cost of education production and its size does not need to be linear. Hence, I add the average district enrollment in the labor market and its square in the Z vector as two factors of the education technology. Voter demographics would determine the local education demand. I get the median earnings, the percent of families with school-age children, the percent of population older than 65, the percent of the adult population with a high school degree but no higher degrees, and the percent of the adult population with a bachelor's degree or higher degrees from Census 2000, and I include these variables in Z as the factors determining the education demand in the labor market.

The prevailing wage in the labor markets and the local unemployment rate are the factors which determine the expected wage. For w^o, I use the comparable wage index (CWI) from NCES and Taylor and Fowler (2006). For U, I use the unemployment rates provided by the Bureau of Labor Statistics (BLS).

In addition to these variables, salaries of the public school district personnel may be a function of school district-specific characteristics or individual-specific characteristics for

compensating differentials. For instance, smaller school districts would be expected to have smaller class sizes, which would be perceived as easier to teach, manage or administer, which would in turn result in their employing the personnel with reduced salary rates. Conversely, it may be the case that school districts with a student body that is generally perceived as too difficult to teach or administer can hire their personnel only with a premium. Moreover, because of the higher cost of living and commuting costs in metropolitan areas, school districts located in the center of these areas may be expected to cover up these costs with increase salary rates to be able to hire. In order to control for these effects, I used the district size definitions in the State of Washington, Joint Legislative Audit & Review Committee's School District Cost and Size Study (2010) and include two district size indicators: small districts have an enrollment less than 1,000 students, and medium districts have an enrollment more than or equal to 1,000 and less than or equal to 10,000. According to these definitions, there are 145 small, 120 medium and 31 large districts in Washington in 2005-2006 school year. Additionally, I include the percentage of students in the district eligible to get free or reduced lunch, the percentage of migrant students in the district, the percentage of Hispanic students in the district, and the percentage of black students in the district as student demographics of districts. Furthermore, my model contains a variable measuring the distance from the employee's school district to the center of the closest metropolitan area.

Finally, in order to control for individual-specific characteristics, my model includes indicator variables for the individuals' highest degree (bachelor's degree, master's degree, and doctorate degree), assignment to a Special Education program, ethnicity, gender, and assignment to a high school grade. I also include a dummy variable for the personnel who are in their first year in the district. In addition to that, I add the personnel's years of experience and its square, and their percent of certified contracted time in their major duty. There are two personnel categories in my

study: the first personnel category is teachers, including all major duty elementary, secondary and other teachers in the OSPI records; the second personnel category is principals, including all major duty elementary and secondary principals, elementary and secondary vice principals, and other school administrators in the OSPI records. All of the specifications in this study contain dummy variables for each school year available in the data set. Table 1 and Table 2 provide descriptive statistics on the variables used in this analysis.

TABLE 1.—DESCRIPTIVE STATISTICS, TEACHER CATEGORY (MULTIPLE PAGES)

Variable	Mean	Standard Deviation	Minimum	Maximum
Total final salary	47,882	9,974	29,131	73,024
HHI	0.134	0.115	0.033	1
Average district enrollment	6,925	3,455	212	10,441
Median income	25,351	4,458	9,488	30,088
Percent households with school aged children	0.285	0.015	0.23	0.307
Percent population over age 65	0.112	0.022	0.085	0.226
Percent adults with high school degree only	0.6	0.068	0.488	0.701
Percent adults with at least bachelor's degree	0.267	0.088	0.122	0.44
Unemployment rate	5.963	1.686	1.6	13.5
Comparable wage index	1.102	0.153	0.766	1.387
Metropolitan area	0.608	0.488	0	1
1997-1998 school year	0.103	0.304	0	1
1998-1999 school year	0.101	0.301	0	1
1999-2000 school year	0.106	0.307	0	1
2000-2001 school year	0.108	0.31	0	1
2001-2002 school year	0.116	0.321	0	1
2002-2003 school year	0.117	0.321	0	1
2003-2004 school year	0.115	0.319	0	1
2004-2005 school year	0.118	0.323	0	1
2005-2006 school year	0.117	0.321	0	1
Small district	0.053	0.225	0	1
Medium district	0.383	0.486	0	1
Percent low income students	0.21	0.218	0	0.973
Percent migrant students	0.008	0.046	0	0.962
Percent Hispanic students	0.11	0.154	0	1
Percent black students	0.06	0.07	0	0.25
Distance from major metropolitan areas	23.4	16.7	1.6	128
Years of experience	13.8	9.2	0	53.8
Bachelor's degree	0.429	0.495	0	1
Master's degree	0.556	0.497	0	1
Doctorate degree	0.006	0.077	0	1
Special Education	0.092	0.289	0	1
Certified contracted time in major duty	0.915	0.185	0	1
Asian	0.026	0.158	0	1
Black	0.016	0.127	0	1
Hispanic	0.021	0.144	0	1
Indian	0.008	0.087	0	1

TABLE 1.—DESCRIPTIVE STATISTICS, TEACHER CATEGORY (MULTIPLE PAGES)

Variable	Mean	Standard Deviation	Minimum	Maximum
Female	0.749	0.434	0	1
New in district	0.035	0.184	0	1
High school	0.384	0.486	0	1

Number of observations = 276,795

TABLE 2.—DESCRIPTIVE STATISTICS, PRINCIPAL CATEGORY (MULTIPLE PAGES)

Variable	Mean	Standard Deviation	Minimum	Maximum
Total final salary	82,212	9,691	64,528	113,603
HHI	0.124	0.112	0.033	1
Average district enrollment	7,264	3,361	260	10,441
Median income	25,681	4,230	9,488	30,088
Percent households with school aged children	0.285	0.014	0.23	0.307
Percent population over age 65	0.111	0.021	0.085	0.226
Percent adults with high school degree only	0.6	0.068	0.488	0.701
Percent adults with at least bachelor's degree	0.27	0.088	0.122	0.44
Unemployment rate	5.909	1.628	1.6	11.9
Comparable wage index	1.114	0.147	0.766	1.387
Metropolitan area	0.649	0.477	0	1
1997-1998 school year	0.089	0.285	0	1
1998-1999 school year	0.091	0.288	0	1
1999-2000 school year	0.104	0.305	0	1
2000-2001 school year	0.112	0.316	0	1
2001-2002 school year	0.115	0.319	0	1
2002-2003 school year	0.119	0.324	0	1
2003-2004 school year	0.119	0.324	0	1
2004-2005 school year	0.126	0.331	0	1
2005-2006 school year	0.125	0.331	0	1
Small district	0.022	0.148	0	1
Medium district	0.395	0.489	0	1
Percent low income students	0.214	0.214	0	0.972
Percent migrant students	0.008	0.043	0	0.539
Percent Hispanic students	0.104	0.14	0	0.946
Percent black students	0.064	0.074	0	0.25
Distance from major metropolitan areas	22.2	16.4	1.6	128
Years of experience	19.5	8.2	0	46.5
Bachelor's degree	0.027	0.163	0	1

TABLE 2.—DESCRIPTIVE STATISTICS, PRINCIPAL CATEGORY (MULTIPLE PAGES)

Variable	Mean	Standard Deviation	Minimum	Maximum
Master's degree	0.93	0.256	0	1
Doctorate degree	0.042	0.201	0	1
Special Education	0.014	0.116	0	1
Certified contracted time in major duty	0.971	0.129	0	1
Asian	0.029	0.169	0	1
Black	0.056	0.23	0	1
Hispanic	0.028	0.164	0	1
Indian	0.013	0.112	0	1
Female	0.486	0.5	0	1
New in district	0.071	0.257	0	1
High school	0.098	0.298	0	1

Number of observations = 15,524

We can write the specification for each personnel category as:

$$\ln(W_{idmt}) = \alpha_1 H_{mt} + \alpha_2 H_{mt}^2 + \alpha_{3j} Z'_{mt} + \alpha_4 w^o_{mt} + \alpha_5 U_{mt} + \alpha_{6k} D'_{dt} + \alpha_{7l} P'_{it} + \varepsilon_{idmt} \quad (15)$$

where the dependent variable is the natural logarithm of the current total final salary of the individual i at the school district d in the education market m in the school year t. D is a vector of district-specific variables, P is a vector of personnel-specific variables, ε_{idmt} is the error term, and $\alpha = (\alpha_1, \alpha_2, \alpha_{3j}, \alpha_4, \alpha_5, \alpha_{6k}, \alpha_{7l})$ is the parameter vector to be estimated.

5. Regression Results

Since the variables in Z vector, Herfindahl index, unemployment rate, and comparable wage index do not change within the education markets, I correct the standard errors by stacking the observations in CBSA clusters and generating a CBSA cluster-robust covariance matrix estimator. Table 3 report the OLS estimation results of the model in (15). The estimation results with the teacher category illustrate that there is a significant relationship between the HHI and total

teacher salaries, and the relationship is of nonlinear pattern for both of the personnel categories. That is, when the concentration in the education market is low, the salaries of the personnel decrease as competition in the education market decreases, but when the concentration is high, the salaries of the personnel increase as competition in the education market decreases. The estimation results with the principal category, on the other hand, show no significant relationship between the HHI and total principal salaries. The local minimums of the wages with respect to the HHI are different for different personnel: For teachers, the salaries increase with concentration if HHI exceeds 0.35. On the other hand, for principal, the salaries begin to increase with concentration once HHI is more than 0.68, but the test for joint significance of HHI terms rejects such a relationship.

TABLE 3.—LINEAR ESTIMATION OF THE MAIN SPECIFICATION
(MULTIPLE PAGES)

	Teacher	Principal
HHI	-0.157***	-0.089
	(0.041)	(0.062)
HHI, squared	0.222***	0.066
	(0.065)	(0.054)
Average district enrollment	0.004	0.024***
	(0.006)	(0.007)
log(Median income)	-0.046**	-0.034
	(0.017)	(0.029)
Percent households with school aged children	-0.036	0.231
	(0.213)	(0.261)
Percent population over age 65	0.065	0.332*
	(0.118)	(0.180)
Percent adults with high school degree only	0.251***	0.157
	(0.084)	(0.113)
Percent adults with at least bachelor's degree	0.059	0.162*
	(0.057)	(0.083)
Unemployment rate	-0.002	0.002
	(0.001)	(0.003)
Comparable wage index	0.173***	-0.000
	(0.061)	(0.068)
Metropolitan area	0.009	0.018**
	(0.005)	(0.008)
1997-1998 school year	7.973***	8.496***
	(0.151)	(0.281)
1998-1999 school year	7.968***	8.510***
	(0.151)	(0.280)
1999-2000 school year	8.008***	8.546***
	(0.152)	(0.280)
2000-2001 school year	8.024***	8.580***
	(0.152)	(0.276)
2001-2002 school year	8.045***	8.624***
	(0.154)	(0.273)
2002-2003 school year	8.070***	8.660***
	(0.153)	(0.273)
2003-2004 school year	8.074***	8.668***
	(0.152)	(0.273)
2004-2005 school year	8.074***	8.684***
	(0.151)	(0.273)
2005-2006 school year	8.082***	8.716***
	(0.150)	(0.272)

TABLE 3.—LINEAR ESTIMATION OF THE MAIN SPECIFICATION (MULTIPLE PAGES)

	Teacher	Principal
Small district	-0.043***	-0.099***
	(0.005)	(0.010)
Medium district	-0.022***	-0.040***
	(0.003)	(0.006)
Percent low income students	0.013	-0.029
	(0.014)	(0.021)
Percent migrant students	0.011	0.023
	(0.013)	(0.015)
Percent Hispanic students	0.036**	0.032
	(0.016)	(0.038)
Percent black students	-0.100***	0.045*
	(0.029)	(0.026)
log(Distance from major metropolitan areas)	-0.005	-0.006
	(0.005)	(0.005)
Years of experience	0.038***	0.005***
	(0.001)	(0.000)
Years of experience, squared	-0.001***	-0.000***
	(0.000)	(0.000)
Bachelor's degree	-0.048***	-0.021
	(0.005)	(0.029)
Master's degree	0.058***	-0.002
	(0.004)	(0.026)
Doctorate degree	0.074***	0.033
	(0.009)	(0.028)
Special Education	-0.011***	-0.020*
	(0.001)	(0.011)
Certified contracted time in major duty	0.014***	0.047***
	(0.002)	(0.011)
Asian	0.007***	0.007
	(0.001)	(0.005)
Black	-0.002	0.002
	(0.003)	(0.001)
Hispanic	-0.006***	0.001
	(0.002)	(0.004)
Indian	-0.002	-0.012
	(0.005)	(0.010)
Female	-0.027***	-0.012***
	(0.002)	(0.002)
New in district	-0.022***	-0.019***
	(0.001)	(0.002)

TABLE 3.—LINEAR ESTIMATION OF THE MAIN SPECIFICATION
(MULTIPLE PAGES)

	Teacher	Principal
High school	0.019***	-0.012**
	(0.002)	(0.005)
Observations	276,795	15,524
R^2	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0023	p = 0.3602
$\alpha_1 + \alpha_2 = 0$	p = 0.0484	p = 0.3715

Note: The dependent variable is log(Total final salary). Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

The existence of the nonlinear relationship between competition and personnel salaries indicates that there are multiple forces shaping the pattern. As I discussed before, oligopsony power of the school districts would pull down the salaries of the personnel, while the rent-sharing and the power of the unions would increase the wages. The results indicate that the oligopsony effect dominates the rent-sharing and union power effects in relatively less concentrated education markets. In relatively less competitive markets, however, rent-sharing and union power effects dominate the oligopsony effect. Taylor (2010) finds that the HHI at which teacher salaries start increasing is 0.54 in Texas. In Washington, however, I find the local minimum to be at 0.35. Texas is a right-to-work state, but Washington is a union state. The difference between these two states can be attributed to the increase in the teachers' bargaining power due to unionization.

In order to have a better understanding of the effects of HHI on school district personnel wages, I handle the endogeneity problem due to the simultaneity of HHI and wages. In order to alleviate the endogeneity problem, instruments such as those presented in Hoxby (2000) can be used. Hoxby explains that streams played an important role in the delineation of the school district boundaries in the eighteen and nineteen centuries and hence these natural boundaries are key

determinants of supply of school districts even though they are not limiting the student transportation today. In a comment, Rothstein (2007) offers alternative categories of streams grouped into two different size categories as instruments. I follow Hoxby and Rothstein and use the U.S. Geological Survey (USGS) Geographic Names Information System (GNIS) data to create two categories of streams based on the length of the streams defining streams longer than 3.5 miles as large, and others as small.[5] I consider using the counts of the two different types of streams in a district's county as two separate instruments for our endogenous concentration measure.

Other than these two instrumental variables, I use the land area of the education market and the total enrollment per square mile in the education market as instrumental variables for the HHI. These instruments would capture the profit potential of the education markets, which is explored in Grosskopf, Hayes and Taylor (2004). I measure the total enrollment per square mile in the education market with a one year lag in order to ensure its exogeneity to the current school year. Summary statistics of all of the instrumental variables I employ are presented in Table 4.

[5] The data I use is the one Rothstein mentions in his comment as the "alternative version of GNIS data" which includes coordinates of two points for each stream in each county: one of the points is the origin where that stream starts traversing that county, and the other point is the destination where that stream ends traversing that county. The length between these two points is calculated by using the haversine formula.

TABLE 4.—DESCRIPTIVE STATISTICS OF THE INSTRUMENTAL VARIABLES

Variable	Mean	Standard Deviation	Minimum	Maximum
Teacher Category				
Count of small streams in the district's county	140.5	91.8	0	379
Count of large streams in the district's county	65.8	36.5	0	226
Total land area of the education market	3,887.9	2,112.9	174.9	5,894.0
Total enrollment per square mile in the market	59.72	37.16	0.48	116.93
Number of observations = 276,795				
Principal Category				
Count of small streams in the district's county	145.2	88.3	0	379
Count of large streams in the district's county	66.6	33.2	0	226
Total land area of the education market	4,040.3	2,112.6	174.9	5,894.0
Total enrollment per square mile in the market	62.77	35.97	0.48	116.93
Number of observations = 15,524				

The first and second columns of Table 5 report the two-stage least squares (2SLS) estimation results of the model in (15). The endogeneity test statistic is 17.314 for the HHI and its square—the two potentially endogenous regressors—in the teacher column, and 17.263 in the principal column. The probability of the exogeneity of the regressors is equal to 0.0002 in both cases. Hence, the test shows that the HHI and its square need to be treated as endogenous. The Partial R^2 of Shea (1997) is 0.2434 for the HHI and 0.0733 for the squared HHI indicating that both of the endogenous regressors are not weakly identified. Still, I also test the relevance of potentially endogenous regressors with Anderson and Rubin (1949) and Stock and Wright (2000) tests which are robust in the presence of weak instruments. The tests reject the null hypothesis suggesting that endogenous regressors are not irrelevant. Finally, Hansen's J statistic is 26.171 so

the test does not reject the joint null hypothesis that the instruments for HHI and its square are valid.

According to the 2SLS results, teachers' salaries begin to increase with concentration at a relatively similar level of HHI at 0.36. This would mean that the bargaining power of the teachers union in Washington is about the same as that in the OLS estimation results. On the other hand, 2SLS results indicate that principals' salaries begin to increase by concentration if concentration is more than 0.23. This finding is significantly different than the corresponding finding in the OLS estimation. Here, we see that principals may have significantly more bargaining power than what is suggested by the OLS results. Moreover, since 0.23 is smaller than 0.36, the inference is that the principals union may actually have relatively more bargaining power than the teachers union in Washington, or that the number of available principals in the market is significantly smaller than the number of teachers, which may give the principals relatively more bargaining power. It should also be noted that the results show that other variables being constant, the salaries of both teachers and principals are greater in a perfectly concentrated market than in a perfectly competitive market.

TABLE 5.—IV AND GMM ESTIMATIONS OF THE MAIN SPECIFICATION (MULTIPLE PAGES)

	2SLS		GMM	
	Teacher	Principal	Teacher	Principal
HHI	-0.208***	-0.193***	-0.172***	-0.187***
	(0.032)	(0.046)	(0.030)	(0.046)
HHI, squared	0.289***	0.416***	0.316***	0.420***
	(0.066)	(0.117)	(0.066)	(0.116)
Average district enrollment	0.003	0.027***	0.010***	0.028***
	(0.003)	(0.004)	(0.002)	(0.003)
log(Median income)	-0.044***	-0.051***	-0.057***	-0.056***
	(0.011)	(0.019)	(0.010)	(0.018)
Percent households with school aged children	-0.039	0.400**	-0.132	0.381**
	(0.104)	(0.162)	(0.102)	(0.160)
Percent population over age 65	0.057	0.366***	0.042	0.374***
	(0.058)	(0.098)	(0.058)	(0.097)
Percent adults with high school degree only	0.270***	0.185***	0.223***	0.188***
	(0.045)	(0.062)	(0.043)	(0.062)
Percent adults with at least bachelor's degree	0.073**	0.226***	0.075**	0.230***
	(0.031)	(0.051)	(0.031)	(0.051)
Unemployment rate	-0.002	0.005**	-0.000	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)
Comparable wage index	0.161***	0.028	0.136***	0.042
	(0.028)	(0.043)	(0.028)	(0.040)
Metropolitan area	0.005	0.016***	0.012***	0.017***
	(0.003)	(0.005)	(0.003)	(0.005)
1997-1998 school year	7.975***	8.527***	8.094***	8.550***
	(0.073)	(0.142)	(0.067)	(0.138)
1998-1999 school year	7.971***	8.541***	8.091***	8.563***
	(0.072)	(0.141)	(0.067)	(0.138)
1999-2000 school year	8.011***	8.575***	8.134***	8.597***
	(0.072)	(0.140)	(0.066)	(0.137)
2000-2001 school year	8.028***	8.603***	8.155***	8.624***
	(0.072)	(0.137)	(0.065)	(0.135)
2001-2002 school year	8.049***	8.640***	8.176***	8.659***
	(0.071)	(0.135)	(0.065)	(0.133)
2002-2003 school year	8.075***	8.671***	8.205***	8.689***
	(0.070)	(0.134)	(0.063)	(0.132)
2003-2004 school year	8.080***	8.678***	8.209***	8.696***
	(0.069)	(0.134)	(0.063)	(0.132)
2004-2005 school year	8.080***	8.695***	8.210***	8.713***
	(0.069)	(0.133)	(0.062)	(0.130)
2005-2006 school year	8.089***	8.729***	8.216***	8.746***
	(0.069)	(0.131)	(0.062)	(0.129)

TABLE 5.—IV AND GMM ESTIMATIONS OF THE MAIN SPECIFICATION (MULTIPLE PAGES)

	2SLS		GMM	
	Teacher	Principal	Teacher	Principal
Small district	-0.044***	-0.102***	-0.044***	-0.100***
	(0.003)	(0.006)	(0.003)	(0.006)
Medium district	-0.022***	-0.039***	-0.023***	-0.039***
	(0.002)	(0.003)	(0.002)	(0.003)
Percent low income students	0.012	-0.023	0.002	-0.022
	(0.010)	(0.015)	(0.010)	(0.015)
Percent migrant students	0.012	0.034	0.029	0.034
	(0.022)	(0.029)	(0.022)	(0.028)
Percent Hispanic students	0.039***	0.025	0.026***	0.023
	(0.010)	(0.019)	(0.008)	(0.019)
Percent black students	-0.106***	0.036	-0.114***	0.036
	(0.020)	(0.032)	(0.020)	(0.032)
log(Distance from major metropolitan areas)	-0.005**	-0.009***	-0.002	-0.009***
	(0.002)	(0.003)	(0.002)	(0.003)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.048***	-0.022	-0.053***	-0.023
	(0.004)	(0.021)	(0.003)	(0.021)
Master's degree	0.058***	-0.003	0.055***	-0.004
	(0.004)	(0.020)	(0.003)	(0.020)
Doctorate degree	0.074***	0.033*	0.065***	0.032
	(0.005)	(0.020)	(0.005)	(0.020)
Special Education	-0.011***	-0.018**	-0.012***	-0.018**
	(0.001)	(0.007)	(0.001)	(0.007)
Certified contracted time in major duty	0.014***	0.047***	0.013***	0.047***
	(0.002)	(0.010)	(0.002)	(0.010)
Asian	0.007***	0.007**	0.008***	0.008***
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.002	0.002	-0.004***	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Hispanic	-0.006***	0.001	-0.006***	0.001
	(0.001)	(0.003)	(0.001)	(0.003)
Indian	-0.002	-0.012**	-0.004*	-0.012**
	(0.002)	(0.006)	(0.002)	(0.006)
Female	-0.027***	-0.013***	-0.029***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
New in district	-0.022***	-0.019***	-0.023***	-0.019***
	(0.001)	(0.003)	(0.001)	(0.003)

TABLE 5.—IV AND GMM ESTIMATIONS OF THE MAIN SPECIFICATION (MULTIPLE PAGES)

	2SLS		GMM	
	Teacher	Principal	Teacher	Principal
High school	0.019***	-0.013***	0.020***	-0.013***
	(0.001)	(0.003)	(0.001)	(0.003)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0000	p = 0.0002	p = 0.0000	p = 0.0002
$\alpha_1 + \alpha_2 = 0$	p = 0.0798	p = 0.0073	p = 0.0007	p = 0.0046

Note: The dependent variable is log(Total final salary). Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

Baum, Schaffer and Stillman (2003) explain that in the presence of arbitrary heteroskedasticity, the Generalized Method of Moments (GMM) estimator is more efficient than the standard IV estimator. I find that Pagan and Hall (1983) general test statistic rejects the null hypothesis of homoscedasticity. Therefore, I also estimate the second stage of the IV regression with GMM. The results from the second stage GMM regression are presented in the third and fourth columns of Table 5. As can be seen, according to the GMM estimation results, the HHI break point where teachers' wages start increasing with concentration is 0.27—lower than the break point level found with 2SLS. For the principals, GMM results verify the 2SLS finding that the break point is at 0.22. All in all, the GMM results, along with the OLS and 2SLS results, present that there is a u-shaped relationship between the salaries of teachers and principals, and the concentration of the education market. I found that the local minima of these u-shapes are at relatively lower concentration levels compared to the results of Taylor (2010), which is probably due to the personnel's increased bargaining power with the help of unions. Furthermore, I present that the break point concentration levels at which salaries start increasing with concentration are different for teachers and principals.

6. Sensitivity Analysis

The results presented in Table 3 and Table 5 may be sensitive to how competition in the education market is measured. The common approach in the literature is to use Herfindahl-Hirschman indices to measure the market concentration. However, different sets of potential competitors and the geographic definition of the market would change these indices, which, in turn, may change the coefficient estimates, signs and significance of the HHI variables in the regression.

First, the HHI used to generate the results in Table 3 and Table 5 assumes that public school districts and all of the private schools (ALL) belong to the set of potential competitors. This, however, may not be true if private schools are not direct competitors with the public school districts. Hence, measuring the HHI with only public schools (PUB) is one of the alternative approaches that I explore in this section.

Alternatively, the concentration measure may include approved private schools along with the public school districts (APR). In Washington, State Board of Education accepts applications from private schools to approve their standards of health, safety and education. That is, the approval of a private school may indicate that that school is a good substitute for public schools while other private schools which do not have any approval from the State Board of Education may not be considered so. So the potential market participants may include only the approved private schools along with the public schools districts.[6]

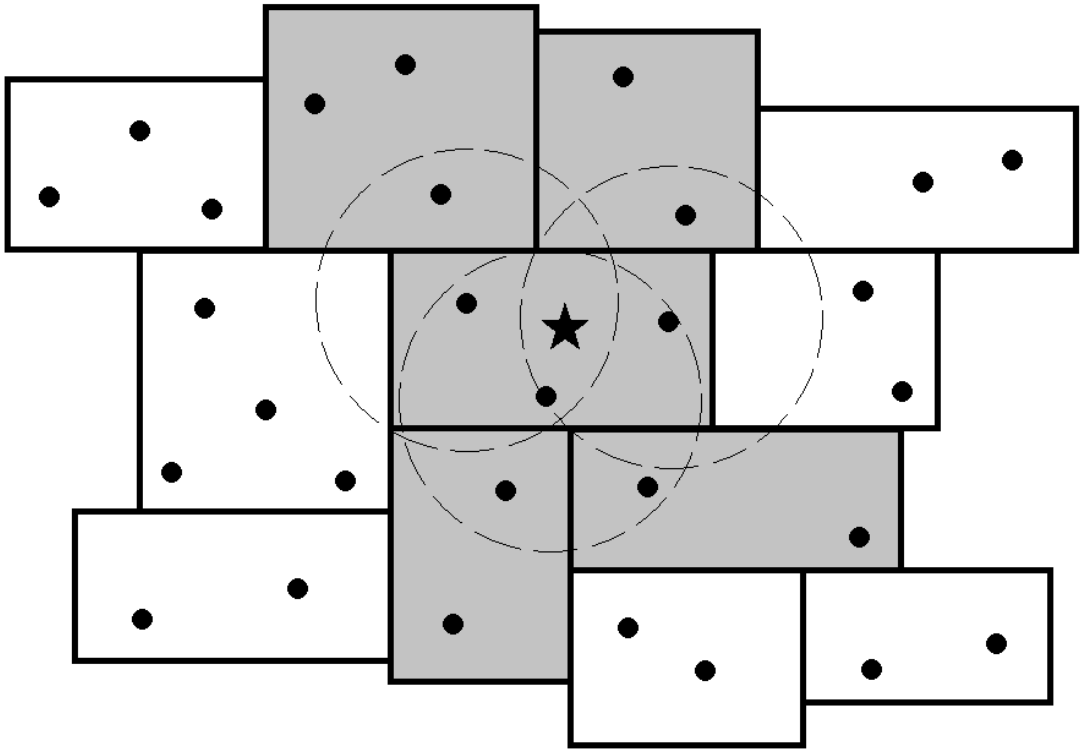
Furthermore, the assumption that the education markets are the CBSAs determined by the OMB may not be suitable. The OMB has certain guidelines based on urban core populations to

[6] Out of 594 private schools in 2011-2012 school year, 379 are approved by the Washington State Board of Education. Total private enrollment is 72,629. Enrollment in approved private schools: 57,268 which corresponds to %79 of the total private enrollment.

determine the CBSAs. However, these guidelines do not necessarily delineate the education markets. Several alternative assumptions about the borders of the education markets can be made which would result in a completely different set of education markets. For instance, one equally plausible assumption can be that counties, instead of the CBSAs, are the separate education markets. This assumption would increase the number of education markets in a state, and would generate different concentration ratios for the counties within a CBSA.

It is also possible to define the district-specific markets by the spatial distribution of the competitors. Simple geometrical shapes such as circles around schools in a district can be used to delineate the relevant education markets for that district. In order to calculate the HHI with such a market definition, I assume that the relevant geographic market for each school district includes all of the districts with at least one school within a 15-mile radius circle (R15) around each of the district's own schools. Figure 1 illustrates this method. In the figure, rectangles represent school districts, and black spots represent schools. There are three schools in the district with the star. When circles of the specified radius are drawn around those schools, we see that four other districts surrounding the star district have schools in those circles. Those districts along with the star district are shaded in gray which represents the education market for the star district. Of course, 15-mile radius is arbitrarily chosen. In order to check the sensitivity on the measure with respect to the size of the radius, I generate two other indices with 25-mile radius (R25), and 50-mile radius (R50) criteria.

FIGURE 1.—THE DETERMINATION OF THE EDUCATION MARKETS WITH THE RADIAL METHOD



Finally, I explore the possibility of the rings in education markets, in which the schools at the outer rings contribute to the competition in the education market less than the schools at the core. This would somehow incorporate the distance between the competitors to the concentration measure. In a sense, rings measure is similar to the radial measure of competition that I assume that the relevant core for each school district includes all of the districts with at least one school within a 15-mile radius circle around each of the district's own schools. In addition to that, however, I also assume that the relevant periphery for each school district includes all of the districts with at least one school within a ring formed by a 15- mile radius and a 50-mile radius circle around each of the district's own schools. I assume that the contribution of the districts in the periphery to the concentration index is by half of what would normally be counted in a Herfindahl index. Because of the peripheral contribution, the ring HHI of concentration for a district would always be smaller than (or in some cases equal to) the 15-mile radius HHI of concentration. Table 6 displays the pairwise correlations between the different HHIs presented in this section, and Table 7 reports their summary statistics.

TABLE 6.—PAIRWISE CORRELATIONS BETWEEN THE HHIS, WASHINGTON DATA

		a	b	c	d	e	f	g	h
HHI-CBSA-ALL	a	1.00							
HHI-R15-ALL	b	0.37	1.00						
HHI-R25-ALL	c	0.37	0.89	1.00					
HHI-R50-ALL	d	0.35	0.70	0.80	1.00				
HHI-County-ALL	e	0.85	0.33	0.32	0.27	1.00			
HHI-CBSA-PUB	f	0.99	0.35	0.36	0.35	0.84	1.00		
HHI-R15-PUB	g	0.39	0.94	0.86	0.78	0.35	0.38	1.00	
HHI-R25-PUB	h	0.38	0.80	0.89	0.87	0.33	0.38	0.89	1.00
HHI-R50-PUB	i	0.34	0.60	0.69	0.92	0.26	0.35	0.72	0.87
HHI-County-PUB	j	0.85	0.32	0.31	0.28	0.97	0.86	0.34	0.33
HHI-CBSA-APR	k	0.99	0.36	0.37	0.35	0.85	0.99	0.38	0.38
HHI-R15-APR	l	0.37	1.00	0.89	0.71	0.33	0.36	0.95	0.81
HHI-R25-APR	m	0.38	0.88	0.99	0.83	0.33	0.37	0.86	0.91
HHI-R50-APR	n	0.35	0.68	0.78	0.99	0.28	0.35	0.77	0.87
HHI-County-APR	o	0.84	0.32	0.32	0.28	0.98	0.84	0.34	0.33
HHI-Rings-ALL	p	0.38	0.98	0.92	0.81	0.33	0.37	0.96	0.86

		i	j	k	l	m	n	o	p
HHI-R50-PUB	i	1.00							
HHI-County-PUB	j	0.27	1.00						
HHI-CBSA-APR	k	0.35	0.86	1.00					
HHI-R15-APR	l	0.62	0.32	0.37	1.00				
HHI-R25-APR	m	0.73	0.32	0.38	0.89	1.00			
HHI-R50-APR	n	0.94	0.28	0.36	0.69	0.81	1.00		
HHI-County-APR	o	0.27	0.97	0.86	0.32	0.32	0.28	1.00	
HHI-Rings-ALL	p	0.71	0.33	0.38	0.99	0.92	0.79	0.33	1.00

Note: The tags following the HHI names denote the market definition and the set of competitors.

TABLE 7.—DESCRIPTIVE STATISTICS OF THE HHIS, WASHINGTON DATA

Variable	Mean	Standard Deviation	Minimum	Maximum
Teacher Category				
HHI (HHI-CBSA-ALL)	0.134	0.115	0.033	1
HHI-R15-ALL	0.059	0.114	0.007	1
HHI-R25-ALL	0.042	0.072	0.007	1
HHI-R50-ALL	0.023	0.034	0.007	0.642
HHI-County-ALL	0.177	0.116	0.069	1
HHI-CBSA-PUB	0.148	0.124	0.039	1
HHI-R15-PUB	0.071	0.125	0.01	1
HHI-R25-PUB	0.055	0.085	0.01	1
HHI-R50-PUB	0.036	0.048	0.012	0.728
HHI-County-PUB	0.196	0.123	0.09	1
HHI-CBSA-APR	0.136	0.116	0.033	1
HHI-R15-APR	0.06	0.115	0.007	1
HHI-R25-APR	0.044	0.074	0.007	1
HHI-R50-APR	0.024	0.037	0.008	0.67
HHI-County-APR	0.181	0.12	0.073	1
HHI-Rings-ALL	0.041	0.07	0.007	0.821
Number of observations = 276,795				
Principal Category				
HHI (HHI-CBSA-ALL)	0.124	0.112	0.033	1
HHI-R15-ALL	0.058	0.107	0.007	1
HHI-R25-ALL	0.042	0.07	0.007	0.983
HHI-R50-ALL	0.023	0.033	0.007	0.513
HHI-County-ALL	0.169	0.11	0.069	1
HHI-CBSA-PUB	0.138	0.122	0.039	1
HHI-R15-PUB	0.07	0.118	0.01	1
HHI-R25-PUB	0.055	0.084	0.01	1
HHI-R50-PUB	0.036	0.048	0.012	0.536
HHI-County-PUB	0.187	0.117	0.09	1
HHI-CBSA-APR	0.127	0.113	0.033	1
HHI-R15-APR	0.059	0.108	0.007	1
HHI-R25-APR	0.044	0.073	0.007	0.983
HHI-R50-APR	0.024	0.036	0.008	0.513
HHI-County-APR	0.173	0.113	0.073	1
HHI-Rings-ALL	0.04	0.066	0.007	0.757
Number of observations = 15,524				

Note: The tags following the HHI names denote the market definition and the set of competitors.

Table 8 through Table 15 present the GMM estimation results of the model in with different measures of competition. First, the results show that holding everything else constant, measuring the HHI with three different sets of competitors does not change the signs or significance of the results. For the teacher category, the location of the minimum wage with respect to the HHI is at HHI=0.29 in the HHI-CBSA-PUB column, and at HHI=0.27 in the HHI-CBSA-APR column. For the principal category, the location of the minimum wage with respect to the HHI is at HHI=0.24 in the HHI-CBSA-PUB column, and at HHI=0.22 in the HHI-CBSA-APR column. That is, the location of the local minimum with respect to HHI does not seem to change much as the sets of competitors used to measure the HHI change.

Secondly, employing different market definitions change the results. The results with the HHIs measured with the market defined as counties are somewhat similar to that with the market defined as CBSAs. Radial measures of the HHI present a non-linear relationship between personnel salaries and the HHI as well. The significance and the pattern of this relationship, however, are different than that when the market is defined as CBSAs, and they change as the size of the radius changes. To give an example, for the teacher category, the location of the minimum wage with respect to the HHI is at HHI=0.46 in the HHI-R15-ALL column and the HHI terms are jointly significant at the 1% level. In the HHI-R25-ALL column, however, teachers' minimum wage with respect to the HHI is at HHI=0.41 with a joint significance at the 10% level.

TABLE 8.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 1
(MULTIPLE PAGES)

	HHI-R15-ALL		HHI-R25-ALL	
	Teacher	Principal	Teacher	Principal
Specified HHI	-0.762***	-0.445	-1.620**	-0.937
	(0.235)	(0.283)	(0.699)	(0.719)
Specified HHI, squared	0.831***	0.908**	1.956**	2.216**
	(0.269)	(0.376)	(0.962)	(0.937)
Average district enrollment	-0.001	0.030***	-0.008	0.028***
	(0.006)	(0.007)	(0.010)	(0.009)
log(Median income)	0.020	0.014	0.072	0.019
	(0.034)	(0.057)	(0.065)	(0.080)
Percent households with school aged children	-0.274	0.322	-0.458	0.030
	(0.205)	(0.197)	(0.340)	(0.293)
Percent population over age 65	0.060	0.416***	-0.232	0.065
	(0.150)	(0.159)	(0.258)	(0.209)
Percent adults with high school degree only	-0.008	0.009	-0.090	-0.038
	(0.092)	(0.150)	(0.157)	(0.212)
Percent adults with at least bachelor's degree	-0.227**	0.034	-0.350**	-0.034
	(0.092)	(0.157)	(0.166)	(0.243)
Unemployment rate	-0.008***	0.001	-0.011**	-0.003
	(0.003)	(0.004)	(0.005)	(0.006)
Comparable wage index	0.039	-0.072	-0.076	-0.161
	(0.067)	(0.093)	(0.145)	(0.146)
Metropolitan area	0.004	0.016*	-0.030	0.005
	(0.007)	(0.008)	(0.020)	(0.025)
1997-1998 school year	7.785***	8.130***	7.624***	8.367***
	(0.205)	(0.341)	(0.319)	(0.366)
1998-1999 school year	7.785***	8.146***	7.629***	8.387***
	(0.203)	(0.338)	(0.315)	(0.361)
1999-2000 school year	7.836***	8.187***	7.686***	8.432***
	(0.201)	(0.334)	(0.309)	(0.354)
2000-2001 school year	7.890***	8.221***	7.769***	8.480***
	(0.198)	(0.325)	(0.292)	(0.329)
2001-2002 school year	7.920***	8.272***	7.794***	8.537***
	(0.196)	(0.320)	(0.293)	(0.325)
2002-2003 school year	7.966***	8.316***	7.854***	8.591***
	(0.193)	(0.313)	(0.284)	(0.311)
2003-2004 school year	7.975***	8.325***	7.865***	8.605***
	(0.192)	(0.310)	(0.281)	(0.305)
2004-2005 school year	8.006***	8.350***	7.915***	8.638***
	(0.190)	(0.304)	(0.271)	(0.291)
2005-2006 school year	8.019***	8.386***	7.932***	8.676***
	(0.189)	(0.302)	(0.269)	(0.288)

TABLE 8.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 1
(MULTIPLE PAGES)

	HHI-R15-ALL		HHI-R25-ALL	
	Teacher	Principal	Teacher	Principal
Small district	-0.048***	-0.117***	-0.046***	-0.100***
	(0.006)	(0.013)	(0.007)	(0.008)
Medium district	-0.013***	-0.035***	-0.015***	-0.035***
	(0.004)	(0.004)	(0.005)	(0.004)
Percent low income students	0.012	-0.042**	0.043	-0.035
	(0.018)	(0.018)	(0.030)	(0.025)
Percent migrant students	0.091*	0.065	0.144	0.081
	(0.047)	(0.044)	(0.090)	(0.075)
Percent Hispanic students	0.003	0.039	-0.029	0.031
	(0.018)	(0.028)	(0.037)	(0.047)
Percent black students	-0.105***	0.030	-0.117***	0.023
	(0.021)	(0.034)	(0.030)	(0.038)
log(Distance from major metropolitan areas)	-0.001	-0.016***	0.004	-0.013*
	(0.006)	(0.006)	(0.008)	(0.008)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.049***	-0.020	-0.052***	-0.017
	(0.004)	(0.023)	(0.004)	(0.024)
Master's degree	0.058***	-0.001	0.054***	0.001
	(0.004)	(0.022)	(0.004)	(0.022)
Doctorate degree	0.070***	0.033	0.068***	0.035
	(0.005)	(0.022)	(0.005)	(0.023)
Special Education	-0.010***	-0.017**	-0.010***	-0.022***
	(0.001)	(0.008)	(0.001)	(0.009)
Certified contracted time in major duty	0.017***	0.058***	0.016***	0.057***
	(0.002)	(0.012)	(0.002)	(0.011)
Asian	0.007***	0.005	0.007***	0.007***
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.001	0.001	-0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Hispanic	-0.007***	0.000	-0.006***	0.001
	(0.001)	(0.003)	(0.002)	(0.003)
Indian	-0.004	-0.015***	-0.003	-0.012**
	(0.003)	(0.005)	(0.003)	(0.005)
Female	-0.028***	-0.014***	-0.027***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
New in district	-0.020***	-0.020***	-0.020***	-0.020***
	(0.001)	(0.003)	(0.002)	(0.003)

TABLE 8.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 1
(MULTIPLE PAGES)

	HHI-R15-ALL		HHI-R25-ALL	
	Teacher	Principal	Teacher	Principal
High school	0.018***	-0.017***	0.018***	-0.012***
	(0.001)	(0.004)	(0.001)	(0.004)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0040	p = 0.0237	p = 0.0671	p = 0.0352
$\alpha_1 + \alpha_2 = 0$	p = 0.6466	p = 0.0093	p = 0.5330	p = 0.0200

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 9.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 2
(MULTIPLE PAGES)

	HHI-R50-ALL		HHI-County-ALL	
	Teacher	Principal	Teacher	Principal
Specified HHI	-3.824*	-1.669	-0.318***	-0.379***
	(2.157)	(1.130)	(0.066)	(0.091)
Specified HHI, squared	14.081	10.990	0.504***	0.582***
	(13.380)	(7.915)	(0.103)	(0.147)
Average district enrollment	0.007	0.031***	0.007***	0.023***
	(0.010)	(0.010)	(0.003)	(0.003)
log(Median income)	0.099	-0.011	-0.048***	-0.035*
	(0.080)	(0.045)	(0.012)	(0.019)
Percent households with school aged children	-0.230	0.279	0.044	0.665***
	(0.420)	(0.289)	(0.123)	(0.185)
Percent population over age 65	-0.315	0.141	0.096	0.450***
	(0.453)	(0.392)	(0.070)	(0.098)
Percent adults with high school degree only	-0.171	0.054	0.283***	0.285***
	(0.247)	(0.124)	(0.054)	(0.064)
Percent adults with at least bachelor's degree	-0.274*	0.137	0.121***	0.287***
	(0.165)	(0.112)	(0.035)	(0.057)
Unemployment rate	-0.006	0.005	-0.000	0.005**
	(0.004)	(0.003)	(0.001)	(0.002)
Comparable wage index	-0.177	-0.078	0.108***	-0.028
	(0.206)	(0.108)	(0.033)	(0.042)
Metropolitan area	-0.046*	0.011	0.011***	0.014***
	(0.025)	(0.021)	(0.004)	(0.005)
1997-1998 school year	7.370***	8.357***	7.971***	8.322***
	(0.348)	(0.285)	(0.091)	(0.162)
1998-1999 school year	7.379***	8.375***	7.969***	8.337***
	(0.341)	(0.282)	(0.090)	(0.161)
1999-2000 school year	7.441***	8.414***	8.014***	8.374***
	(0.330)	(0.279)	(0.089)	(0.161)
2000-2001 school year	7.493***	8.450***	8.035***	8.408***
	(0.328)	(0.263)	(0.088)	(0.158)
2001-2002 school year	7.520***	8.491***	8.061***	8.452***
	(0.317)	(0.268)	(0.087)	(0.156)
2002-2003 school year	7.581***	8.529***	8.091***	8.487***
	(0.303)	(0.262)	(0.085)	(0.155)
2003-2004 school year	7.593***	8.541***	8.099***	8.497***
	(0.298)	(0.261)	(0.085)	(0.155)
2004-2005 school year	7.652***	8.571***	8.097***	8.514***
	(0.284)	(0.246)	(0.084)	(0.154)
2005-2006 school year	7.672***	8.611***	8.105***	8.550***
	(0.274)	(0.249)	(0.084)	(0.152)

TABLE 9.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 2
(MULTIPLE PAGES)

	HHI-R50-ALL		HHI-County-ALL	
	Teacher	Principal	Teacher	Principal
Small district	-0.046**	-0.100**	-0.047***	-0.106***
	(0.020)	(0.044)	(0.003)	(0.006)
Medium district	-0.020***	-0.037***	-0.024***	-0.040***
	(0.007)	(0.005)	(0.002)	(0.003)
Percent low income students	0.038	-0.028	-0.007	-0.038***
	(0.053)	(0.050)	(0.010)	(0.014)
Percent migrant students	0.137	0.039	0.033	0.037
	(0.098)	(0.064)	(0.025)	(0.031)
Percent Hispanic students	-0.021	0.036	0.029***	0.041**
	(0.032)	(0.041)	(0.009)	(0.019)
Percent black students	-0.161***	0.034	-0.111***	0.055*
	(0.042)	(0.054)	(0.021)	(0.033)
log(Distance from major metropolitan areas)	-0.020	-0.013	-0.003	-0.008***
	(0.022)	(0.012)	(0.002)	(0.003)
Years of experience	0.038***	0.005***	0.039***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000**	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.050***	-0.021	-0.052***	-0.021
	(0.004)	(0.023)	(0.003)	(0.021)
Master's degree	0.055***	-0.001	0.055***	-0.002
	(0.005)	(0.022)	(0.003)	(0.020)
Doctorate degree	0.071***	0.033	0.065***	0.036*
	(0.006)	(0.023)	(0.005)	(0.020)
Special Education	-0.010***	-0.018*	-0.012***	-0.017**
	(0.001)	(0.009)	(0.001)	(0.008)
Certified contracted time in major duty	0.017***	0.057***	0.014***	0.046***
	(0.002)	(0.013)	(0.002)	(0.010)
Asian	0.008***	0.008***	0.008***	0.006**
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.000	0.001	-0.003*	0.001
	(0.003)	(0.003)	(0.002)	(0.002)
Hispanic	-0.005***	0.001	-0.006***	-0.001
	(0.002)	(0.003)	(0.001)	(0.003)
Indian	-0.002	-0.013	-0.002	-0.011*
	(0.015)	(0.015)	(0.002)	(0.006)
Female	-0.027***	-0.013***	-0.028***	-0.013***
	(0.001)	(0.003)	(0.001)	(0.001)
New in district	-0.021***	-0.019***	-0.023***	-0.019***
	(0.002)	(0.004)	(0.001)	(0.003)

TABLE 9.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 2
(MULTIPLE PAGES)

	HHI-R50-ALL		HHI-County-ALL	
	Teacher	Principal	Teacher	Principal
High school	0.018***	-0.014	0.019***	-0.014***
	(0.001)	(0.009)	(0.001)	(0.003)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0329	p = 0.3153	p = 0.0000	p = 0.0001
$\alpha_1 + \alpha_2 = 0$	p = 0.3667	p = 0.1863	p = 0.0000	p = 0.0009

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 10.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 3
(MULTIPLE PAGES)

	HHI-CBSA-PUB		HHI-R15-PUB	
	Teacher	Principal	Teacher	Principal
Specified HHI	-0.169***	-0.183***	-1.315***	-0.585*
	(0.029)	(0.044)	(0.416)	(0.309)
Specified HHI, squared	0.296***	0.381***	1.346***	1.006**
	(0.060)	(0.104)	(0.480)	(0.408)
Average district enrollment	0.010***	0.028***	-0.004	0.027***
	(0.002)	(0.003)	(0.008)	(0.006)
log(Median income)	-0.057***	-0.052***	0.086	0.042
	(0.010)	(0.017)	(0.060)	(0.061)
Percent households with school aged children	-0.127	0.375**	-0.134	0.224
	(0.100)	(0.156)	(0.370)	(0.223)
Percent population over age 65	0.031	0.354***	-0.040	0.364**
	(0.059)	(0.096)	(0.281)	(0.178)
Percent adults with high school degree only	0.226***	0.183***	-0.158	-0.015
	(0.043)	(0.062)	(0.158)	(0.151)
Percent adults with at least bachelor's degree	0.079***	0.225***	-0.392***	-0.005
	(0.030)	(0.050)	(0.151)	(0.152)
Unemployment rate	0.000	0.006***	-0.012**	0.003
	(0.001)	(0.002)	(0.005)	(0.004)
Comparable wage index	0.135***	0.038	-0.078	-0.062
	(0.027)	(0.040)	(0.127)	(0.094)
Metropolitan area	0.012***	0.017***	-0.026*	0.007
	(0.003)	(0.004)	(0.016)	(0.013)
1997-1998 school year	8.086***	8.528***	7.450***	7.948***
	(0.065)	(0.139)	(0.358)	(0.379)
1998-1999 school year	8.082***	8.541***	7.455***	7.965***
	(0.065)	(0.139)	(0.355)	(0.377)
1999-2000 school year	8.126***	8.576***	7.512***	8.005***
	(0.064)	(0.138)	(0.350)	(0.372)
2000-2001 school year	8.146***	8.602***	7.580***	8.035***
	(0.063)	(0.136)	(0.345)	(0.367)
2001-2002 school year	8.167***	8.637***	7.617***	8.083***
	(0.062)	(0.134)	(0.341)	(0.362)
2002-2003 school year	8.195***	8.667***	7.681***	8.127***
	(0.061)	(0.133)	(0.334)	(0.355)
2003-2004 school year	8.200***	8.674***	7.696***	8.136***
	(0.060)	(0.133)	(0.332)	(0.353)
2004-2005 school year	8.201***	8.691***	7.748***	8.169***
	(0.060)	(0.132)	(0.325)	(0.346)
2005-2006 school year	8.207***	8.725***	7.767***	8.206***
	(0.060)	(0.130)	(0.323)	(0.344)

TABLE 10.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 3
(MULTIPLE PAGES)

	HHI-CBSA-PUB		HHI-R15-PUB	
	Teacher	Principal	Teacher	Principal
Small district	-0.044***	-0.101***	-0.041***	-0.112***
	(0.003)	(0.006)	(0.009)	(0.012)
Medium district	-0.023***	-0.039***	-0.005	-0.033***
	(0.002)	(0.003)	(0.008)	(0.005)
Percent low income students	0.004	-0.020	0.017	-0.041**
	(0.010)	(0.015)	(0.024)	(0.016)
Percent migrant students	0.029	0.036	0.199**	0.097*
	(0.022)	(0.028)	(0.096)	(0.053)
Percent Hispanic students	0.025***	0.021	-0.027	0.024
	(0.008)	(0.019)	(0.031)	(0.030)
Percent black students	-0.116***	0.035	-0.183***	0.011
	(0.019)	(0.032)	(0.038)	(0.035)
log(Distance from major metropolitan areas)	-0.002	-0.009***	-0.015	-0.024***
	(0.002)	(0.003)	(0.010)	(0.008)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.052***	-0.023	-0.049***	-0.018
	(0.003)	(0.021)	(0.004)	(0.024)
Master's degree	0.055***	-0.004	0.056***	0.000
	(0.003)	(0.020)	(0.004)	(0.022)
Doctorate degree	0.066***	0.032	0.073***	0.034
	(0.005)	(0.020)	(0.005)	(0.023)
Special Education	-0.012***	-0.018**	-0.010***	-0.017**
	(0.001)	(0.007)	(0.001)	(0.008)
Certified contracted time in major duty	0.013***	0.047***	0.018***	0.057***
	(0.002)	(0.010)	(0.003)	(0.012)
Asian	0.008***	0.008***	0.006***	0.004
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.004***	0.002	-0.000	0.001
	(0.001)	(0.002)	(0.002)	(0.002)
Hispanic	-0.006***	0.001	-0.005***	0.000
	(0.001)	(0.003)	(0.002)	(0.004)
Indian	-0.004*	-0.012**	-0.003	-0.013**
	(0.002)	(0.006)	(0.003)	(0.005)
Female	-0.029***	-0.013***	-0.027***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
New in district	-0.023***	-0.019***	-0.019***	-0.019***
	(0.001)	(0.003)	(0.002)	(0.003)

TABLE 10.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 3
(MULTIPLE PAGES)

	HHI-CBSA-PUB		HHI-R15-PUB	
	Teacher	Principal	Teacher	Principal
High school	0.020***	-0.013***	0.018***	-0.017***
	(0.001)	(0.003)	(0.001)	(0.004)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0000	p = 0.0002	p = 0.0067	p = 0.0305
$\alpha_1 + \alpha_2 = 0$	p = 0.0005	p = 0.0039	p = 0.8870	p = 0.0154

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 11.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 4
(MULTIPLE PAGES)

	HHI-R25-PUB		HHI-R50-PUB	
	Teacher	Principal	Teacher	Principal
Specified HHI	-1.807**	-1.324*	-3.616***	-1.638**
	(0.714)	(0.715)	(1.240)	(0.717)
Specified HHI, squared	2.726**	2.454**	12.247**	7.559**
	(1.209)	(1.148)	(4.950)	(3.109)
Average district enrollment	0.004	0.031***	0.000	0.019**
	(0.007)	(0.007)	(0.008)	(0.009)
log(Median income)	0.106	0.077	0.129**	-0.004
	(0.070)	(0.084)	(0.063)	(0.037)
Percent households with school aged children	-0.422	-0.081	-0.348	0.081
	(0.406)	(0.365)	(0.364)	(0.218)
Percent population over age 65	-0.360	0.090	-0.437	0.087
	(0.328)	(0.277)	(0.312)	(0.283)
Percent adults with high school degree only	-0.122	-0.153	-0.141	0.020
	(0.170)	(0.211)	(0.165)	(0.091)
Percent adults with at least bachelor's degree	-0.343**	-0.164	-0.297**	0.036
	(0.157)	(0.213)	(0.140)	(0.082)
Unemployment rate	-0.010*	-0.003	-0.004	0.004*
	(0.005)	(0.005)	(0.004)	(0.002)
Comparable wage index	-0.176	-0.226	-0.140	0.011
	(0.174)	(0.191)	(0.116)	(0.076)
Metropolitan area	-0.047**	-0.019	-0.036**	0.016
	(0.024)	(0.028)	(0.017)	(0.012)
1997-1998 school year	7.389***	7.990***	7.132***	8.428***
	(0.368)	(0.422)	(0.341)	(0.222)
1998-1999 school year	7.397***	8.014***	7.140***	8.443***
	(0.363)	(0.415)	(0.337)	(0.220)
1999-2000 school year	7.459***	8.062***	7.199***	8.475***
	(0.356)	(0.405)	(0.331)	(0.217)
2000-2001 school year	7.530***	8.123***	7.249***	8.514***
	(0.344)	(0.388)	(0.325)	(0.209)
2001-2002 school year	7.567***	8.181***	7.277***	8.550***
	(0.341)	(0.380)	(0.323)	(0.209)
2002-2003 school year	7.635***	8.243***	7.334***	8.586***
	(0.329)	(0.366)	(0.315)	(0.204)
2003-2004 school year	7.651***	8.262***	7.347***	8.596***
	(0.326)	(0.360)	(0.312)	(0.203)
2004-2005 school year	7.713***	8.313***	7.411***	8.629***
	(0.315)	(0.344)	(0.298)	(0.195)
2005-2006 school year	7.740***	8.356***	7.439***	8.664***
	(0.311)	(0.339)	(0.292)	(0.193)

TABLE 11.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 4
(MULTIPLE PAGES)

	HHI-R25-PUB		HHI-R50-PUB	
	Teacher	Principal	Teacher	Principal
Small district	-0.042***	-0.097***	-0.048***	-0.095***
	(0.009)	(0.010)	(0.009)	(0.016)
Medium district	-0.009	-0.031***	-0.014***	-0.037***
	(0.007)	(0.006)	(0.005)	(0.004)
Percent low income students	0.021	-0.030	0.025	-0.020
	(0.024)	(0.021)	(0.025)	(0.023)
Percent migrant students	0.169*	0.121	0.153**	0.083
	(0.091)	(0.075)	(0.076)	(0.054)
Percent Hispanic students	-0.023	-0.003	-0.011	0.008
	(0.029)	(0.038)	(0.021)	(0.026)
Percent black students	-0.193***	-0.011	-0.159***	0.048
	(0.048)	(0.049)	(0.033)	(0.039)
log(Distance from major metropolitan areas)	-0.020**	-0.020**	-0.024***	-0.010*
	(0.009)	(0.008)	(0.009)	(0.005)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.052***	-0.011	-0.049***	-0.020
	(0.004)	(0.025)	(0.004)	(0.023)
Master's degree	0.053***	0.005	0.056***	-0.002
	(0.004)	(0.024)	(0.004)	(0.022)
Doctorate degree	0.070***	0.040*	0.074***	0.035
	(0.005)	(0.024)	(0.005)	(0.022)
Special Education	-0.010***	-0.022**	-0.010***	-0.012
	(0.001)	(0.009)	(0.001)	(0.009)
Certified contracted time in major duty	0.018***	0.053***	0.018***	0.053***
	(0.002)	(0.012)	(0.002)	(0.011)
Asian	0.006***	0.005*	0.007***	0.006**
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.000	-0.000	-0.002	0.000
	(0.002)	(0.003)	(0.002)	(0.003)
Hispanic	-0.004**	0.001	-0.005***	0.001
	(0.002)	(0.003)	(0.002)	(0.003)
Indian	-0.003	-0.009	-0.005	-0.017*
	(0.003)	(0.006)	(0.006)	(0.009)
Female	-0.027***	-0.014***	-0.027***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.002)
New in district	-0.020***	-0.020***	-0.020***	-0.018***
	(0.002)	(0.003)	(0.002)	(0.003)

TABLE 11.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 4
(MULTIPLE PAGES)

	HHI-R25-PUB		HHI-R50-PUB	
	Teacher	Principal	Teacher	Principal
High school	0.018***	-0.011**	0.018***	-0.016***
	(0.001)	(0.004)	(0.001)	(0.005)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0384	p = 0.0869	p = 0.0031	p = 0.0519
$\alpha_1 + \alpha_2 = 0$	p = 0.1196	p = 0.0299	p = 0.0213	p = 0.0153

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 12.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 5
(MULTIPLE PAGES)

	HHI-County-PUB		HHI-CBSA-APR	
	Teacher	Principal	Teacher	Principal
Specified HHI	-0.359***	-0.384***	-0.170***	-0.187***
	(0.063)	(0.085)	(0.030)	(0.045)
Specified HHI, squared	0.520***	0.552***	0.314***	0.418***
	(0.093)	(0.129)	(0.065)	(0.116)
Average district enrollment	0.007***	0.023***	0.010***	0.028***
	(0.003)	(0.003)	(0.002)	(0.003)
log(Median income)	-0.042***	-0.029	-0.058***	-0.055***
	(0.011)	(0.018)	(0.010)	(0.018)
Percent households with school aged children	0.090	0.668***	-0.129	0.386**
	(0.123)	(0.179)	(0.101)	(0.159)
Percent population over age 65	0.103	0.454***	0.042	0.374***
	(0.071)	(0.098)	(0.058)	(0.097)
Percent adults with high school degree only	0.306***	0.279***	0.223***	0.187***
	(0.051)	(0.060)	(0.043)	(0.062)
Percent adults with at least bachelor's degree	0.148***	0.303***	0.076**	0.229***
	(0.037)	(0.054)	(0.031)	(0.051)
Unemployment rate	-0.001	0.005**	0.000	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)
Comparable wage index	0.088***	-0.045	0.137***	0.041
	(0.032)	(0.041)	(0.028)	(0.040)
Metropolitan area	0.008**	0.013***	0.012***	0.017***
	(0.004)	(0.005)	(0.003)	(0.004)
1997-1998 school year	7.910***	8.288***	8.092***	8.546***
	(0.090)	(0.157)	(0.067)	(0.138)
1998-1999 school year	7.910***	8.304***	8.089***	8.559***
	(0.089)	(0.157)	(0.067)	(0.138)
1999-2000 school year	7.955***	8.343***	8.132***	8.593***
	(0.088)	(0.156)	(0.066)	(0.137)
2000-2001 school year	7.977***	8.375***	8.153***	8.620***
	(0.088)	(0.154)	(0.065)	(0.135)
2001-2002 school year	8.003***	8.419***	8.174***	8.655***
	(0.086)	(0.152)	(0.065)	(0.133)
2002-2003 school year	8.035***	8.455***	8.202***	8.685***
	(0.085)	(0.151)	(0.063)	(0.131)
2003-2004 school year	8.042***	8.465***	8.206***	8.691***
	(0.084)	(0.151)	(0.063)	(0.131)
2004-2005 school year	8.045***	8.485***	8.208***	8.709***
	(0.084)	(0.149)	(0.062)	(0.130)
2005-2006 school year	8.052***	8.521***	8.213***	8.742***
	(0.083)	(0.148)	(0.062)	(0.129)

TABLE 12.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 5
(MULTIPLE PAGES)

	HHI-County-PUB		HHI-CBSA-APR	
	Teacher	Principal	Teacher	Principal
Small district	-0.047***	-0.107***	-0.044***	-0.101***
	(0.003)	(0.006)	(0.003)	(0.006)
Medium district	-0.024***	-0.040***	-0.023***	-0.039***
	(0.002)	(0.003)	(0.002)	(0.003)
Percent low income students	-0.006	-0.034**	0.002	-0.021
	(0.010)	(0.014)	(0.010)	(0.015)
Percent migrant students	0.034	0.038	0.028	0.034
	(0.024)	(0.030)	(0.022)	(0.028)
Percent Hispanic students	0.032***	0.039**	0.026***	0.023
	(0.009)	(0.018)	(0.008)	(0.019)
Percent black students	-0.118***	0.046	-0.115***	0.036
	(0.019)	(0.032)	(0.020)	(0.032)
log(Distance from major metropolitan areas)	-0.004*	-0.009***	-0.002	-0.009***
	(0.002)	(0.003)	(0.002)	(0.003)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.052***	-0.021	-0.052***	-0.023
	(0.003)	(0.021)	(0.003)	(0.021)
Master's degree	0.055***	-0.002	0.055***	-0.004
	(0.003)	(0.020)	(0.003)	(0.020)
Doctorate degree	0.065***	0.035*	0.065***	0.032
	(0.005)	(0.020)	(0.005)	(0.020)
Special Education	-0.012***	-0.017**	-0.012***	-0.018**
	(0.001)	(0.007)	(0.001)	(0.007)
Certified contracted time in major duty	0.013***	0.046***	0.013***	0.047***
	(0.002)	(0.010)	(0.002)	(0.010)
Asian	0.007***	0.006**	0.008***	0.008***
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.003*	0.001	-0.004***	0.002
	(0.002)	(0.002)	(0.001)	(0.002)
Hispanic	-0.007***	-0.001	-0.006***	0.001
	(0.001)	(0.003)	(0.001)	(0.003)
Indian	-0.002	-0.011*	-0.004*	-0.012**
	(0.002)	(0.006)	(0.002)	(0.006)
Female	-0.028***	-0.013***	-0.029***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
New in district	-0.023***	-0.019***	-0.023***	-0.019***
	(0.001)	(0.003)	(0.001)	(0.003)

TABLE 12.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 5
(MULTIPLE PAGES)

	HHI-County-PUB		HHI-CBSA-APR	
	Teacher	Principal	Teacher	Principal
High school	0.019***	-0.014***	0.020***	-0.013***
	(0.001)	(0.003)	(0.001)	(0.003)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0002
$\alpha_1 + \alpha_2 = 0$	p = 0.0000	p = 0.0005	p = 0.0005	p = 0.0044

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 13.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 6
(MULTIPLE PAGES)

	HHI-R15-APR		HHI-R25-APR	
	Teacher	Principal	Teacher	Principal
Specified HHI	-0.785***	-0.433	-1.806**	-1.026
	(0.244)	(0.273)	(0.767)	(0.716)
Specified HHI, squared	0.819***	0.885**	2.249**	2.320**
	(0.269)	(0.361)	(1.145)	(0.987)
Average district enrollment	-0.003	0.030***	-0.008	0.028***
	(0.007)	(0.007)	(0.010)	(0.009)
log(Median income)	0.028	0.015	0.104	0.033
	(0.036)	(0.058)	(0.076)	(0.086)
Percent households with school aged children	-0.305	0.303	-0.502	-0.013
	(0.220)	(0.197)	(0.398)	(0.326)
Percent population over age 65	0.011	0.407***	-0.324	0.036
	(0.167)	(0.157)	(0.310)	(0.226)
Percent adults with high school degree only	-0.004	0.016	-0.116	-0.058
	(0.093)	(0.145)	(0.177)	(0.211)
Percent adults with at least bachelor's degree	-0.232**	0.038	-0.378**	-0.056
	(0.094)	(0.151)	(0.180)	(0.240)
Unemployment rate	-0.008***	0.001	-0.012**	-0.003
	(0.003)	(0.004)	(0.005)	(0.006)
Comparable wage index	0.027	-0.073	-0.152	-0.194
	(0.071)	(0.094)	(0.176)	(0.167)
Metropolitan area	-0.000	0.015	-0.043*	-0.000
	(0.008)	(0.009)	(0.024)	(0.027)
1997-1998 school year	7.745***	8.115***	7.448***	8.287***
	(0.212)	(0.345)	(0.378)	(0.401)
1998-1999 school year	7.746***	8.132***	7.456***	8.309***
	(0.211)	(0.342)	(0.372)	(0.394)
1999-2000 school year	7.797***	8.172***	7.517***	8.355***
	(0.209)	(0.338)	(0.365)	(0.387)
2000-2001 school year	7.854***	8.207***	7.606***	8.407***
	(0.204)	(0.328)	(0.346)	(0.360)
2001-2002 school year	7.884***	8.257***	7.632***	8.465***
	(0.203)	(0.324)	(0.346)	(0.356)
2002-2003 school year	7.932***	8.301***	7.701***	8.522***
	(0.199)	(0.316)	(0.334)	(0.340)
2003-2004 school year	7.941***	8.310***	7.713***	8.537***
	(0.198)	(0.313)	(0.331)	(0.334)
2004-2005 school year	7.975***	8.336***	7.769***	8.574***
	(0.195)	(0.307)	(0.319)	(0.318)
2005-2006 school year	7.987***	8.371***	7.790***	8.613***
	(0.194)	(0.305)	(0.316)	(0.315)

TABLE 13.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 6
(MULTIPLE PAGES)

	HHI-R15-APR		HHI-R25-APR	
	Teacher	Principal	Teacher	Principal
Small district	-0.048***	-0.116***	-0.046***	-0.098***
	(0.006)	(0.013)	(0.007)	(0.008)
Medium district	-0.012***	-0.035***	-0.014**	-0.035***
	(0.005)	(0.004)	(0.006)	(0.004)
Percent low income students	0.014	-0.042**	0.047	-0.034
	(0.018)	(0.018)	(0.032)	(0.024)
Percent migrant students	0.093*	0.064	0.162*	0.086
	(0.050)	(0.043)	(0.098)	(0.072)
Percent Hispanic students	-0.000	0.040	-0.036	0.028
	(0.020)	(0.028)	(0.041)	(0.046)
Percent black students	-0.108***	0.029	-0.135***	0.017
	(0.022)	(0.034)	(0.035)	(0.040)
log(Distance from major metropolitan areas)	-0.001	-0.016***	0.001	-0.014*
	(0.006)	(0.006)	(0.009)	(0.007)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.050***	-0.020	-0.052***	-0.015
	(0.004)	(0.023)	(0.004)	(0.024)
Master's degree	0.057***	-0.001	0.054***	0.002
	(0.004)	(0.022)	(0.005)	(0.023)
Doctorate degree	0.070***	0.033	0.069***	0.037
	(0.005)	(0.022)	(0.006)	(0.023)
Special Education	-0.010***	-0.017**	-0.010***	-0.023***
	(0.001)	(0.008)	(0.001)	(0.009)
Certified contracted time in major duty	0.017***	0.058***	0.017***	0.057***
	(0.002)	(0.011)	(0.002)	(0.011)
Asian	0.007***	0.005	0.007***	0.007**
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.001	0.001	0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Hispanic	-0.007***	0.000	-0.005***	0.000
	(0.001)	(0.003)	(0.002)	(0.003)
Indian	-0.003	-0.015***	-0.003	-0.012**
	(0.003)	(0.005)	(0.003)	(0.005)
Female	-0.028***	-0.014***	-0.027***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
New in district	-0.020***	-0.020***	-0.020***	-0.020***
	(0.001)	(0.003)	(0.002)	(0.003)

TABLE 13.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 6
(MULTIPLE PAGES)

	HHI-R15-APR		HHI-R25-APR	
	Teacher	Principal	Teacher	Principal
High school	0.018***	-0.017***	0.018***	-0.012***
	(0.001)	(0.004)	(0.001)	(0.004)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0041	p = 0.0228	p = 0.0625	p = 0.0446
$\alpha_1 + \alpha_2 = 0$	p = 0.8324	p = 0.0097	p = 0.4969	p = 0.0254

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 14.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 7
(MULTIPLE PAGES)

	HHI-R50-APR		HHI-County-APR	
	Teacher	Principal	Teacher	Principal
Specified HHI	-4.087*	-1.635	-0.307***	-0.364***
	(2.202)	(1.060)	(0.064)	(0.087)
Specified HHI, squared	15.762	10.185	0.478***	0.553***
	(12.089)	(6.295)	(0.099)	(0.140)
Average district enrollment	0.007	0.029***	0.007***	0.022***
	(0.010)	(0.009)	(0.003)	(0.003)
log(Median income)	0.131	-0.011	-0.043***	-0.028
	(0.093)	(0.044)	(0.012)	(0.019)
Percent households with school aged children	-0.163	0.322	0.048	0.660***
	(0.452)	(0.262)	(0.122)	(0.183)
Percent population over age 65	-0.390	0.135	0.092	0.438***
	(0.415)	(0.337)	(0.071)	(0.098)
Percent adults with high school degree only	-0.215	0.038	0.276***	0.272***
	(0.273)	(0.118)	(0.053)	(0.063)
Percent adults with at least bachelor's degree	-0.296	0.130	0.117***	0.282***
	(0.184)	(0.092)	(0.036)	(0.056)
Unemployment rate	-0.005	0.006*	-0.001	0.005**
	(0.005)	(0.003)	(0.001)	(0.002)
Comparable wage index	-0.233	-0.069	0.101***	-0.042
	(0.221)	(0.108)	(0.032)	(0.042)
Metropolitan area	-0.053*	0.012	0.011***	0.014***
	(0.028)	(0.019)	(0.003)	(0.004)
1997-1998 school year	7.153***	8.369***	7.929***	8.279***
	(0.454)	(0.270)	(0.094)	(0.165)
1998-1999 school year	7.163***	8.386***	7.929***	8.296***
	(0.447)	(0.267)	(0.093)	(0.165)
1999-2000 school year	7.227***	8.424***	7.974***	8.333***
	(0.435)	(0.264)	(0.092)	(0.164)
2000-2001 school year	7.277***	8.459***	7.996***	8.368***
	(0.431)	(0.251)	(0.092)	(0.162)
2001-2002 school year	7.307***	8.501***	8.020***	8.411***
	(0.421)	(0.254)	(0.090)	(0.159)
2002-2003 school year	7.372***	8.538***	8.052***	8.447***
	(0.405)	(0.248)	(0.089)	(0.158)
2003-2004 school year	7.384***	8.548***	8.058***	8.457***
	(0.400)	(0.246)	(0.088)	(0.158)
2004-2005 school year	7.446***	8.578***	8.059***	8.476***
	(0.382)	(0.233)	(0.088)	(0.157)
2005-2006 school year	7.472***	8.619***	8.068***	8.513***
	(0.370)	(0.234)	(0.087)	(0.155)

TABLE 14.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 7
(MULTIPLE PAGES)

	HHI-R50-APR		HHI-County-APR	
	Teacher	Principal	Teacher	Principal
Small district	-0.048***	-0.101***	-0.047***	-0.106***
	(0.018)	(0.034)	(0.003)	(0.006)
Medium district	-0.018***	-0.037***	-0.024***	-0.040***
	(0.007)	(0.004)	(0.002)	(0.003)
Percent low income students	0.032	-0.031	-0.005	-0.036**
	(0.046)	(0.039)	(0.010)	(0.014)
Percent migrant students	0.151	0.051	0.031	0.038
	(0.106)	(0.061)	(0.025)	(0.031)
Percent Hispanic students	-0.016	0.034	0.028***	0.039**
	(0.029)	(0.033)	(0.009)	(0.018)
Percent black students	-0.167***	0.040	-0.116***	0.052
	(0.043)	(0.048)	(0.020)	(0.033)
log(Distance from major metropolitan areas)	-0.026	-0.014	-0.003	-0.008***
	(0.021)	(0.010)	(0.002)	(0.003)
Years of experience	0.038***	0.005***	0.038***	0.005***
	(0.000)	(0.001)	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000**	-0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Bachelor's degree	-0.050***	-0.022	-0.052***	-0.020
	(0.004)	(0.023)	(0.003)	(0.021)
Master's degree	0.055***	-0.002	0.055***	-0.001
	(0.005)	(0.022)	(0.003)	(0.020)
Doctorate degree	0.072***	0.032	0.065***	0.036*
	(0.006)	(0.023)	(0.005)	(0.020)
Special Education	-0.010***	-0.017*	-0.012***	-0.017**
	(0.001)	(0.009)	(0.001)	(0.008)
Certified contracted time in major duty	0.017***	0.057***	0.014***	0.046***
	(0.002)	(0.012)	(0.002)	(0.010)
Asian	0.007***	0.008***	0.008***	0.006**
	(0.002)	(0.003)	(0.002)	(0.003)
Black	-0.001	0.001	-0.003*	0.001
	(0.002)	(0.003)	(0.002)	(0.002)
Hispanic	-0.005***	0.001	-0.006***	-0.001
	(0.002)	(0.003)	(0.001)	(0.003)
Indian	-0.004	-0.014	-0.002	-0.011*
	(0.013)	(0.012)	(0.002)	(0.006)
Female	-0.027***	-0.013***	-0.028***	-0.013***
	(0.001)	(0.002)	(0.001)	(0.001)
New in district	-0.021***	-0.019***	-0.023***	-0.019***
	(0.002)	(0.003)	(0.001)	(0.003)

TABLE 14.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 7
(MULTIPLE PAGES)

	HHI-R50-APR		HHI-County-APR	
	Teacher	Principal	Teacher	Principal
High school	0.017***	-0.015**	0.019***	-0.014***
	(0.001)	(0.008)	(0.001)	(0.003)
Observations	276,795	15,524	276,795	15,524
R^2	0.9998	0.9999	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0397	p = 0.2596	p = 0.0000	p = 0.0001
$\alpha_1 + \alpha_2 = 0$	p = 0.2426	p = 0.1135	p = 0.0000	p = 0.0010

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

TABLE 15.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 8
(MULTIPLE PAGES)

	HHI-Ring-ALL	
	Teacher	Principal
Specified HHI	-1.328***	-0.730*
	(0.408)	(0.444)
Specified HHI, squared	2.440***	2.723**
	(0.831)	(1.097)
Average district enrollment	-0.001	0.030***
	(0.006)	(0.006)
log(Median income)	0.025	0.010
	(0.034)	(0.053)
Percent households with school aged children	-0.339	0.287
	(0.235)	(0.210)
Percent population over age 65	-0.117	0.219
	(0.174)	(0.201)
Percent adults with high school degree only	-0.003	0.025
	(0.088)	(0.139)
Percent adults with at least bachelor's degree	-0.212**	0.073
	(0.083)	(0.139)
Unemployment rate	-0.007**	0.003
	(0.003)	(0.003)
Comparable wage index	-0.004	-0.097
	(0.078)	(0.103)
Metropolitan area	-0.005	0.016
	(0.009)	(0.010)
1997-1998 school year	7.828***	8.220***
	(0.191)	(0.290)
1998-1999 school year	7.830***	8.238***
	(0.189)	(0.287)
1999-2000 school year	7.883***	8.280***
	(0.187)	(0.283)
2000-2001 school year	7.937***	8.308***
	(0.182)	(0.275)
2001-2002 school year	7.967***	8.362***
	(0.181)	(0.270)
2002-2003 school year	8.016***	8.405***
	(0.178)	(0.263)
2003-2004 school year	8.025***	8.415***
	(0.177)	(0.260)
2004-2005 school year	8.062***	8.440***
	(0.174)	(0.254)
2005-2006 school year	8.078***	8.479***
	(0.173)	(0.252)

TABLE 15.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 8 (MULTIPLE PAGES)

	HHI-Ring-ALL	
	Teacher	Principal
Small district	-0.049***	-0.123***
	(0.007)	(0.018)
Medium district	-0.013***	-0.035***
	(0.004)	(0.004)
Percent low income students	0.013	-0.053**
	(0.021)	(0.024)
Percent migrant students	0.103*	0.060
	(0.053)	(0.046)
Percent Hispanic students	0.000	0.048
	(0.021)	(0.030)
Percent black students	-0.118***	0.033
	(0.023)	(0.035)
log(Distance from major metropolitan areas)	-0.007	-0.021**
	(0.007)	(0.008)
Years of experience	0.038***	0.005***
	(0.000)	(0.001)
Years of experience, squared	-0.001***	-0.000***
	(0.000)	(0.000)
Bachelor's degree	-0.050***	-0.022
	(0.004)	(0.023)
Master's degree	0.057***	-0.003
	(0.004)	(0.022)
Doctorate degree	0.070***	0.029
	(0.005)	(0.022)
Special Education	-0.010***	-0.016**
	(0.001)	(0.008)
Certified contracted time in major duty	0.017***	0.057***
	(0.002)	(0.011)
Asian	0.007***	0.005
	(0.002)	(0.003)
Black	-0.001	0.001
	(0.002)	(0.002)
Hispanic	-0.006***	0.000
	(0.001)	(0.003)
Indian	-0.005*	-0.018***
	(0.003)	(0.007)
Female	-0.028***	-0.014***
	(0.001)	(0.002)
New in district	-0.020***	-0.020***
	(0.001)	(0.003)

TABLE 15.—GMM ESTIMATION RESULTS WITH DIFFERENT HHIS – 8 (MULTIPLE PAGES)

	HHI-Ring-ALL	
	Teacher	Principal
High school	0.018***	-0.019***
	(0.001)	(0.005)
Observations	276,795	15,524
R^2	0.9998	0.9999
$\alpha_1 = 0 \; and \; \alpha_2 = 0$	p = 0.0046	p = 0.0313
$\alpha_1 + \alpha_2 = 0$	p = 0.0400	p = 0.0085

Note: The dependent variable is log(Total final salary). The tags following the HHI names denote the market definition and the set of competitors. Standard errors are in parentheses. Triple asterisk (***) means significance at the 1% level. Double asterisk (**) means significance at the 5% level. Single asterisk (*) means significance at the 10% level.

Furthermore, when the markets are defined as rings, the results show that the teachers' salaries begin to increase with concentration at HHI=0.27 and the principals' salaries begin to increase with concentration at HHI=0.13. While most of the measures of concentration I explore indicate a significant non-linear relationship between the personnel salaries and the HHI, different HHIs result in different levels of HHIs where the minimum wage occurs. The results in Table 8 to Table 15 present that the salaries of teachers start increasing when concentration exceeds the HHI level somewhere in the [0.13, 0.49] range, and the salaries of principals start increasing when concentration exceeds the HHI level somewhere in the [0.08, 0.35] range.

In conclusion, the findings in Table 8 through Table 15 indicate that the significance and the pattern of the relationship between salaries and concentration are not too sensitive to adding the private schools in the set of competitors. Changing the definition of education markets, on the other hand, changes the significance and the pattern of the relationship significantly. Yet, most of the measures of concentration I employ validate the non-linear relationship between the salaries of the school personnel and the concentration in the education market. Moreover, almost all of the results in the tables imply that salaries of principals start increasing at a lower level of

concentration compared to the level at which teachers' salaries start increasing. This, again, may be an indication of principals' relatively higher bargaining power.

7. Concluding Remarks

I summarize the major findings of my analysis of the relationship between competition and education personnel salaries in Washington as follows: First, I find that the relationship between wages and market concentration is of a nonlinear pattern for both of the personnel categories. I present that when the concentration in the education market is low, the salaries of the personnel decrease as competition in the education market decreases, but when the concentration is high, the salaries of the personnel increase as competition in the education market decreases. Secondly, when I control for the endogeneity of the concentration measure, my findings show that the nonlinear pattern of the relationship is significant. Furthermore, I report evidence that principals have more bargaining power over their salaries than teachers in Washington, that principals start getting positive returns from increasing concentration at lower levels of concentration (at around 0.225) than that of teachers (at around 0.315). I also compare the pattern of teacher salaries versus concentration in Washington with that in Texas (at around 0.54), and show that the inflection point in Washington is at lower levels of concentration. This finding can be attributed to Washington's being a union state versus Texas's being a right-to-work-state.

Additionally, I test the sensitivity of my analysis to using different measures of competition. My results indicate that the effects of competition on wages are robust to measuring the competition with different sets of competitors. On the other hand, I find that the effect of concentration on education personnel salaries is rather sensitive to using different definitions of the education markets. When the education markets are defined in different ways, the effect of

concentration on wages is not significant in a few cases, or if the concentration effect is significant, the nonlinear relationship between wages and concentration distorts to some extent. All in all, however, I find that the teacher salaries start increasing when market concentration exceeds the HHI level somewhere in the [0.13, 0.49] range, and the principal salaries start increasing when concentration exceeds the HHI level somewhere in the [0.08, 0.35] range.

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