School Revenue Limits and Teacher Salaries: Evidence from Wisconsin

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Abstract: In this paper, I analyze how state-adopted caps on school district revenue and teacher salary increases have affected the distribution of teacher salaries in Wisconsin. Specifically, a fixed effects model is used to estimate the effect that these policy changes have had on beginning and experienced teacher salaries and confirms that the revenue limits have had different effects on different districts, with high-salary districts being more strongly affected. I then estimate a model of compensating differentials to uncover changes in relative wages for districts that serve disadvantaged student populations.

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I. Introduction

In the early 1990's, the Wisconsin Legislature implemented two policies that restricted school district spending: caps on the amount of revenue a district can raise with the local property tax, and the Qualified Economic Offering (QEO) law which limits teacher salary increases. There has been much debate in the education community over how these policies have affected, and will affect, the quality of education in Wisconsin. This study addresses one branch of this debate and asks whether and how these policy changes have impacted teacher salaries and what implications this might have for teacher quality and mobility.

Both policies were originally implemented for reasons that had little to do with quality of education in Wisconsin. The revenue caps were intended to provide property tax relief, while the QEO law was largely a response to a mediation and arbitration law considered biased toward teacher unions and rising teacher salaries. Opponents of both policies claim that they have caused real teacher salaries to fall and have reduced the ability of districts to attract and retain high quality teachers. It has been argued that this has contributed to recent teacher shortages in Milwaukee and poorer rural districts. However, the limited analysis to date has generally been in the form of summaries of average salaries and opinion surveys of administrators (Wisconsin Education Association Council, 1998b, 1998c; Wisconsin Association of School Boards, 2000). Using more detailed methods, this study addresses several questions about teacher salaries under the revenue limits and QEO law. First, what happened to teacher salaries in Wisconsin during the 1990's – did they increase, decrease or remain unchanged? Is there a difference in salary

levels and growth trends before and after the reforms took effect?[1] Is there a difference in the behavior of salaries for beginning, experienced and average teachers? How do changes in teacher salaries compare to changes in other wages in the state? To answer these questions, a descriptive analysis first gives a general overview of beginning, experienced and average teacher salaries for most of the decade. A fixed effects model is then estimated to provide a parametric analysis of the effect that the policy changes have had on salaries. Finally, a model of compensating differentials is estimated before and after the reforms in order to address the question of whether and how relative salaries between districts may have changed.

Although the revenue caps have affected many aspects of district spending and quality, this study focuses specifically on the impact of the policy changes on teacher salaries. There is an abundance of research on the relationship between school spending and student performance (see Hanushek, 1986 and1996, and Hedges and Greenwald, 1996), but relatively little is known about the mechanisms through which changes in district spending affect students. We do know that teachers are one of the most important inputs of education production (Ehrenberg and Brewer, 1994), and that higher salaries attract higher quality teachers (Figlio, 1997). This study attempts to shed some light inside the educational black box by examining the relationship between spending restrictions and teacher salaries, which in turn influence the quality of teachers in a district. Also, it is found in Imazeki (2000) that relative wages are important determinants of inter-district transfers, and that transfer rates in Wisconsin were slightly higher after 1993. If the revenue caps and QEO law have affected relative wages, this may suggest that these policies are contributing to teacher mobility and attrition.

[1] Because the two policies took effect at virtually the same time, it is extremely difficult to distinguish the effects of the QEO law on teacher salaries from the effects of revenue limits; this study does not try to separate these effects but focuses on what has happened to teacher salaries before and after both policies took effect.

II. Background

Wisconsin's school district revenue limits and the Qualified Economic Offering law both took effect in the 1993-94 school year. The first of these policies imposed limits on the total amount of revenue that a district can raise through a combination of general state aid and the local property tax. The caps were largely intended to provide property tax relief. They became even more important in 1995-96, when the state government committed to funding two-thirds of school spending; the revenue limits allow the state to meet that commitment while also limiting the growth of the state's financial obligation. The original policy limited increases in revenue per pupil to a specific dollar amount ($190 in 1993-94), or the rate of inflation times the per pupil cost (whichever was higher for a district), from base levels set at 1992-93 levels. In 1995-96, three major revisions were made: increases in revenue per pupil were set at the fixed dollar amount of $206 for all districts; a minimum per-pupil revenue limit was set so that districts with calculated limits below the minimum were allowed to raise their limits to the minimum[2]; and the revenue limit per pupil was calculated with an average of the district's enrollment over the last three years, to decrease the hardship on districts with declining enrollments. Furthermore, in 1998-99, the increase in revenue per pupil was indexed to inflation; the allowable increase in that year was $208.88. The limits can be adjusted for various reasons, such as when a district attaches new property, experiences a loss of Federal Impact Aid funds, or experiences a large decline in enrollment. Districts are also allowed to exceed the limits if they pass a referendum specifically to do so. It should be noted that districts are not *required* to levy the total amount

[2] In 1998-89, the minimum was $6,100 per pupil.

they are allowed; however, the revenue limit in the following year will then be restricted to 75% of the amount under-levied.

The QEO law specifically limits teacher salaries, restricting teacher unions from access to binding arbitration on economic issues as long as the school district management submits a Qualified Economic Offer (QEO). The law was a response to a Mediation and Arbitration law passed in the mid-70's that many believed favored the unions and had contributed to sharply rising teacher salaries during the 1980's. The QEO law was originally meant to be temporary, while the Mediation and Arbitration law was under review, but was made permanent in 1995. The law currently restricts access to arbitration if the QEO is equivalent to a 2.1% increase overall in the salary schedule and a 1.7% increase (as a percentage of the total compensation package) in the cost of benefits. That is, as long as the total wage bill (including salary adjustments for education and experience) increases by 2.1%, the union has no leverage to ask for further increases. The policy does not *mandate* a limit on salaries; districts can choose to increase wages further if they wish. However, according to the Wisconsin Education Association Council (WEAC, which represents union members in most districts), "nearly every school board in Wisconsin – at the urging of the Wisconsin Association of School Boards – has been limiting its offer to the formula contained in the QEO." (WEAC, 1997)

In adopting revenue limits and the QEO law, Wisconsin joined a large group of states that have imposed limits on the ability of local governments to collect and/or spend revenues generated through property taxes. Several states imposed such limits during the 1970's (with California's Proposition 13 perhaps the most famous), leading some to refer to a "property tax revolt". A new round of this tax revolt began in the early 1990's, with states such as Illinois and Michigan adopting policies that limit school district finances.

Over the last twenty years, there has been much research on whether and how these limits have affected revenue and spending. The consensus seems to be that limits have controlled the growth of local government (Figlio, 1998). However, past studies have focused primarily on the size of government (i.e., spending levels) and tell us little about whether service levels have remained the same (which would perhaps imply that taxpayers were correct in thinking limits would reduce inefficiencies) or if service levels have fallen with spending. Downes and Figlio (1999) suggest that it is not enough to know simply how tax limits affect revenues and expenditures; there is a wide range of possible nonfiscal effects as well. In particular, a small and growing literature has begun to look at educational services and directly assess how revenue and expenditure limits have impacted school quality and student outcomes (see Downes and Figlio, 1999, for an excellent summary of this research).

The continuing debate over whether money matters for student performance (see Hanushek, 1986 and 1996, and Hedges and Greenwald, 1996) suggests that changes in district spending due to revenue or expenditure limits may not necessarily affect school outcomes. However, Downes and Figlio point out that several of the theories of why *increased* spending may not *improve* student outcomes could also explain why *decreases* in spending due to tax limits would *hurt* student outcomes. For example, one theory is that because of union power, spending increases go toward rents for experienced teachers. That is, rather than buying better quality teachers, increases in salaries go to experienced teachers who are unlikely to leave the district anyway. Since empirical studies have found little connection between student performance and teacher experience beyond the first few years, this increased spending for salaries would do little to affect student outcomes. Conversely, if revenue is cut, we may expect to see few changes among salaries for experienced teachers who have union power and instead

see lower beginning salaries, which will reduce the quality of incoming teachers. This theory is supported by Figlio and Reuben (1998) who find that the average quality of incoming teachers is lower under tax limitations. The assumption is that this is due, in part, to lower salaries for new teachers. However, there is little empirical evidence of the direct effect of tax limits on teacher salaries. The current study attempts to fill this gap by examining teacher salaries in Wisconsin before and after the imposition of revenue limits and the QEO law.

Anecdotal evidence suggests that real teacher salaries in Wisconsin are, indeed, lower under the policy limitations. Both district administrators and teacher unions have objected to Wisconsin's revenue caps, pointing out that services are being harmed because district expenses have increased at rates in excess of "allowable" amounts. WEAC also claims that the QEO law has led to far lower increases in nominal salaries than prior to the law, has eroded inflation-adjusted salaries and lowers the quality of public education in Wisconsin because it "discourages the best and the brightest from entering and staying in the education profession (WEAC, 1999)." On the other hand, the Wisconsin Association of School Boards (WASB) has offered its own analysis of the QEO law and claims that teacher salaries have outpaced inflation. According to surveys conducted by WEAC and WASB, districts have dealt with the revenue caps in a variety of ways, including reducing spending on building and maintenance, limiting purchases of supplies and textbooks, and laying off staff. The surveys do not explicitly ask about changes in salary (e.g., whether districts have chosen to spend less on salaries or offer smaller annual raises to teachers); however, with the QEO law also in effect, it is certainly likely that one way in which constrained districts can stay within revenue limits is by offering smaller increases to teachers than they would otherwise. This study offers an objective assessment of teacher salaries in Wisconsin and analyzes the effects of the policy changes on the teacher labor market. This is

important because if real teacher salaries have fallen as WEAC claims, it will be more difficult for Wisconsin districts in general to attract and retain high quality teachers.

The WEAC and WASB studies of teacher salaries have also overlooked the possible distributional problems that could arise if limits constrain some districts more than others. That is, because the revenue cap is defined in nominal dollars, high cost (and therefore high spending) districts (such as Milwaukee) may be more constrained, at least in percentage terms. For example, in 1997-98, the $206 increase in revenue per pupil represented an average growth of 2.5% in the revenue base for the decile of highest-spending districts, and average growth of 3.7% for the lowest-spending districts. The highest-spending districts also tend to have more low-income students than the lower-spending districts (an average of 22.7% versus 16.9%). Districts that face higher costs due to factors such as more special education students or a higher proportion of students from economically disadvantaged backgrounds, are likely to need to offer higher salaries to attract teachers of a given quality, i.e., they must offer compensating wages. Imazeki (2000) found that new teachers are sensitive to their current wage relative to the wage they could be earning in other districts. If revenue limits erode salary differentials across districts, then districts that already serve disadvantaged student populations may be made even worse off. Thus, this study examines whether and how revenue limits and the QEO law may have affected these salary differentials.

Finally, this study attempts to verify the theory of union rents mentioned earlier by differentiating between the effect of limits on salaries for beginning teachers from the effect on salaries for more experienced teachers. If beginning teacher salaries are disproportionately affected, this could lower the quality of incoming teachers and increase mobility among new teachers.

III. Wisconsin teacher salaries in the 1990's

Before we look at what has happened to teacher salaries under the revenue limits and QEO law, it is important to emphasize the special nature of teacher salaries, compared to the salary structure in other occupations. In Wisconsin, all public school districts are unionized and teachers are covered by collective bargaining agreements. Each district adheres to a salary ladder under which salary increases are awarded solely for experience in the district and education. A typical salary schedule is shown in the Appendix. There are several education "lanes" and a teacher's salary is determined by the box on the grid into which she falls. If a teacher transfers districts, she is placed at the beginning of her education lane in the new district (that is, the salary grid refers solely to experience in the district); however, previous experience is often given seniority "credit", up to a point.[3] The salary grid applies to all teachers in a district, so that salaries are the same across schools within the district. Teachers often have little choice about which school they are assigned to when first hired and movement between schools within a district is generally predicated on seniority. Finally, teachers achieve tenure after a certain amount of time in the district, after which it is very difficult to fire them (the amount of seniority required for tenure varies by district). Thus, a teacher's salary within a district depends almost entirely on her experience and education level, and there are strong disincentives for teachers to transfer between districts.

Data used here on Wisconsin teacher salaries come from the Wisconsin Department of Public Instruction (DPI). The DPI compiles an annual dataset of all teachers and staff in the

[3] For example, a district may grant one year of "local experience equivalence" for each two years of prior experience, so a teacher with a master's degree who transfers into the district after ten years of experience

public school system, collected on the third Friday in September. The sample used in this study includes anyone who was a full-time teacher in a public school in Wisconsin between the 1990-91 and 1998-99 school years. The data include information on each teacher's gender, race, age, education level and year of degree, years of local (within district) and total experience, full-time equivalency, grade levels taught, salary and fringe salary.[4] The top panel of Table 1 shows the means for these data for three of the sample years. As the analysis here will focus primarily on beginning teachers versus experienced teachers, the averages are shown for all first-year teachers and teachers with more than twenty years of experience.

WEAC and WASB studies of the QEO law have analyzed average salaries and averages of benchmarks (benchmarks refer to six points on the salary schedule, such as the minimum and maximum for a teacher with a BA or MA). However, these measures are problematic because average district salary will depend on the distribution of teacher experience in the district. For example, there have been many retirements in the 1990's. If the distribution of teachers moves from more experienced, educated teachers (who are further along on the salary schedule) to more new, inexperienced teachers (who are at the beginning of the salary ladder), then average salaries will appear to fall. The benchmark average does not have this problem but does not give any information about how raises have been distributed among new and old teachers. That is, the change in the average benchmark measure could look the same if all teachers get the same raise, or if the most experienced teachers get a huge raise and everyone else gets nothing. There is also

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somewhere else, would be placed in the master's lane with five years of experience. These rules for transfer credit differ by district.

[4] Fringe salary is not included in the analysis here because the definition of fringe salary changed in 1994-95. Prior to that year, fringe salary included only extra pay for extra duties such as coaching, overtime or advising a club. In 1994-95, it was re-defined to include benefits such as insurance, retirement and college credit reimbursement. Thus, there is a large increase in average fringe salary in 1994-95 that is unrelated to the policy changes.

very little information about differential effects of the reforms in different districts because averages are calculated for the state, taken across districts.

Table 2 shows annual changes in real teacher salaries during the 1990's using three points in the salary distribution: minimum, maximum and average salaries.[5] Nominal salaries have been converted to 1992 dollars using the national CPI.[6] For comparison, the last row of the table shows changes in average real wage and salary disbursements (per job) for all occupations in Wisconsin. It should be noted that both the QEO law and the revenue caps went into effect in 1993-94; however, not all districts settled their union contracts under the QEO that year.

Since the imposition of the revenue caps and the QEO law, teacher salaries have not matched the growth of other wages in Wisconsin, or even inflation; however, it is not particularly clear that this is a trend that began with the imposition of the limit policies, and the downward trend appears to stop in 1998-99 (though it will require more data to determine whether this is just a one-year anomaly).[7] Beginning teachers have been affected somewhat more than experienced teachers and have seen their relative wages decline (i.e., both relative to other occupations and relative to more experienced teachers), giving some weight to the theory of union rents. These average figures are generally consistent with the claims of the teacher unions that teachers have been losing purchasing power but from these statistics alone, it is difficult to place the blame entirely on the policy changes.

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[5] Due to missing salary data for several districts in 1991-92, the sample for that year is significantly smaller (270 districts versus over 400 in other years). The discrepancies in the number of districts in 1990-91, 1992-93 and 1996-97 are also due to missing or problematic data. Between 1994-95 and 1995-96, two districts consolidated into one. Using only those districts for which data are available in every year, the qualitative analysis is largely unchanged (see footnote in Table 2 for more detail).

[6] Using the regional midwest CPI only changes the values slightly but does not affect the qualitative analysis (i.e., all growth rates are of the same signs and roughly the same magnitudes).

[7] Note that declining real minimum and maximum salaries do not necessarily imply that individual teachers are losing purchasing power since teachers receive annual salary increases for additional experience and education.

The averages in Table 2 do not tell us whether the policies may have affected districts in different ways. Because the annual increases in the per-pupil revenue limits are set in nominal dollars, and are the same for all districts, districts with higher spending are allowed a smaller percentage increase in revenue. To the extent that increases of many non-salary costs are not under the control of the district (e.g., electricity and heating costs), the caps are more likely to bind for these high-spending districts and the effect may be felt in smaller salary increases. Table 3 shows the average annual salary changes for districts in the tenth and ninetieth percentiles of the distributions of low-income students (measured by eligibility for the federal free and reduced price lunch program), per-pupil spending, salary and property wealth. The one clear pattern here is convergence of salaries as districts in the bottom salary decile have had consistent salary growth while those in the top decile have seen falling real salaries. The pattern is much stronger for beginning teachers, though salaries for experienced teachers in high salary districts have also fallen each year.

IV. Fixed effects

The descriptive analysis in Tables 2 and 3 suggests that the revenue limits and QEO law have possibly had some effect on teacher salaries, particularly in high salary districts; however, we cannot isolate the effects of the policy changes by looking at changes in these averages alone. Perhaps the decrease in salaries is due to changes in some other factor during the 1990's such as falling student enrollments, or changes in district demographics, or changes in the public's willingness to pay for education. It would be helpful to perform a more precise analysis that can take into account other factors that may have been changing during this time period and that

would affect teacher salaries. Therefore, following Figlio (1999), I estimate a parametric fixed-effect model:

$$(1) \qquad S_{j,t} = \beta_L L_{j,t} + \beta_D D_{j,t} + T_t + \lambda_j + \varepsilon_{j,t}$$

Here, $S_{j,t}$ is the minimum or maximum salary for district *j* in year *t*, $L_{j,t}$ is a dummy variable that equals one if district *j* is subject to revenue limits in year *t* and zero otherwise, $D_{j,t}$ is a vector of observable, time-varying district characteristics, T_t is a year-specific effect (i.e., dummy variables for each school year), λ_j is a district-specific fixed effect (i.e., dummy variables for each district, capturing unobserved, time-invariant heterogeneity), and $\varepsilon_{j,t}$ is a random error term. Note that because revenue limits were imposed statewide beginning in 1993-94, $L_{j,t}$ should equal one for all districts in the years 1993-94 and after. However, districts do have the option to exceed the revenue limits by referendum. The referendum must be specifically to override the revenue cap and increase revenue (and therefore levies) by a specified amount. Several districts have passed such referenda and for these districts, $L_{j,t}$ will equal zero.[8,9] For example, in 1998-99, 64 districts held referenda to exceed the revenue cap; 36 were passed with an average increase of $227 per pupil (the 28 that failed asked for an average increase of $233 per pupil)[10].

For estimation of the fixed effect model (and the compensating differential models discussed in the next section), data on student and district characteristics are attached to the

[8] By defining $L_{j,t}$ in this way, it becomes endogenous, since it is highly likely that districts who choose to exceed the revenue caps have a greater "taste" for education and are likely to offer higher salaries to attract good teachers. However, this endogenity should be at least partially accounted for by the district fixed effect.

[9] Ideally, we could also include a similar measure for the QEO law. However, creating such a measure is quite problematic because districts are not *required* to restrict salaries to the 2.1% limit set by the QEO law. Determining which districts restricted themselves and which did not is extremely difficult due to very noisy data on total wages.

teacher sample. There are a number of district characteristics that are likely to affect teacher salaries, either because teachers demand compensating wages (for example, high cost of living or a more demanding student population), or because they reflect the community's demand for and willingness to pay for quality teachers (e.g., the income and education distribution of the community). These are discussed in greater detail in the next section on compensating wages. As Figlio (1999) points out, many of these variables are not likely to change very quickly and, to the extent that they have been constant during the 1990's, they are absorbed into the district fixed effect.[11] Factors that are constant over time but affect all districts will be absorbed into the time dummies. $D_{j,t}$ thus includes variables which are measurable, vary across districts and vary over time; here, these are student enrollment and proportion of students from economically disadvantaged backgrounds, represented by the percent of students eligible for the federal free and reduced price lunch program. For 1992-93 through 1998-99, these data are available from the DPI; for earlier years, the data are taken from the National Center for Education Statistics' Common Core of Data. Means are shown in the bottom panel of Table 1.

It is quite likely that the revenue limits, particularly in combination with the QEO law, have had different effects on salaries in different types of districts. As mentioned earlier, because the allowable increase in revenue per pupil is in nominal dollars, high-spending districts may be more constrained than low-spending districts. We have also seen that on average, districts at the top end of the salary distribution may be more adversely affected than those at the bottom. To explore these issues, the limit dummy is interacted with several different variables. In particular, specifications three through nine show the limit dummy interacted with the prelimit

[10] Districts that held referenda that did not passed are treated the same as districts that did not hold referenda at all; that is, $L_{j,t}$ is equal to one.

[11] In practice, many of these variables are also only available for one point in time, taken from the 1990 Census.

minimum or maximum salary, prelimit spending per-pupil, an indicator variable for Milwaukee and combinations of these variables.

Equation (1) is estimated as log-linear and estimated with both the natural log of minimum salaries and the natural log of maximum salaries as the dependent variable. The results are shown in Tables 4 and 5. In each table, the specification in column 1 includes only the revenue limit dummy, time effects and district fixed effects (the intercept and time dummies are not shown here). In the specifications in each of the other columns, the log of district enrollment and percent low-income students are also included. The results in the first two columns suggest that the revenue limits have not, on average, had much of an impact of teacher salaries as the coefficients are not statistically significant and the magnitudes are extremely small. It is perhaps odd that limits appear to be correlated with *higher* salaries; for the average district, being constrained by the limits increases minimum salaries by 0.6% to 0.9% (roughly $144 to $216 at the mean), and maximum salaries by 0.5% to 1.0% ($210 to $400 at the mean). However, when the limit dummy is interacted with other variables, the results are consistent with the analysis in Table 3 and suggest that limits have had very different effects on salaries in districts at different points in the salary distribution. For districts with high salaries in 1992-93 the limits have a negative effect on both minimum and maximum salaries of roughly 2.0%. Thus, although the effect of the limits is consistently positive at the means, the effect for districts at the ninetieth percentile of salaries is consistently negative. However, it should be pointed out that the magnitude of the effect at either end of the distribution is not particularly large.

It is interesting to note that in Milwaukee, limits have negatively affected minimum salaries but maximum salaries have increased under the limits. This is consistent with the theory

of union rents and it may be that experienced teachers in Milwaukee have managed to push salary cuts onto new teachers while maintaining their own salary levels.

V. Compensating Differentials

The fixed effect model estimation suggests that the revenue limits have had quite different effects on different districts, with little to no effect on many districts but depressing salaries in high spending/high salary districts. This equalizing of salaries could have important implications for teacher quality and teacher mobility. In earlier work, this author found that new teachers who transfer between districts are sensitive to their current wage relative to the wage they could be earning in other districts (Imazeki, 2000). If changes in districts' salary structures affect relative wages across districts, then inter-district mobility could be affected as well. In particular, from an equity perspective, we would like to know whether wages are changing in a way that makes poor, or otherwise disadvantaged districts, better or worse off. When salary levels are relatively high in a district, it is generally either because the district needs to offer higher wages to compensate teachers for negative district characteristics, or because the district is wealthy and wants to offer higher wages to attract high quality teachers (i.e., there is a high taste for teacher quality). In the first case, the lowering of wages in poor districts may *increase* mobility out of these disadvantaged districts, as teachers leave for 'better' districts (that is, the poor districts' relative wage worsens); in the latter case, lower wages in wealthy districts could *decrease* mobility in poor districts as relative wages in poor districts rise.

To shed more light on how the revenue limits and QEO law have affected relative wages, a model of compensating differentials is estimated. The standard wage equation is based in theories of human capital and compensating wage differentials:

$$(2) \qquad \ln W_i = \beta_X X_i + \beta_J J_j + \varepsilon_i$$

where W represents the salary for teacher *i*, X_i is a vector of teacher characteristics such as education and experience, J_j is a vector of nonwage job characteristics, and ε_i is a random error term. It should be noted that perhaps the most important teacher characteristic, her ability to effectively educate students, is largely unobservable and is not included in this analysis. Equation (2) is estimated for two groups of teachers – beginning teachers in their first-year of teaching, and experienced teachers with more than 20 years of district experience – and at three points in time.

The basic theory behind equation (2) is that teachers have preferences over wages and district characteristics and are willing to trade a somewhat lower salary in order to work in a district with attributes they desire, or conversely, they command a salary premium for disamenities. For example, Antos and Rosen (1975) and Levinson (1988) both find that white teachers demand higher wages for teaching nonwhite students (though these authors disagree about the size and interpretation of their results). Although districts can do little to change these characteristics, districts do differ in their ability and willingness to pay for teachers and these differences may also lead to variation in teacher salaries. That is, equation (2) is the reduced-form of a simultaneous model of supply and demand for teachers.

As Levinson (1988) points out, some variables are likely to reflect both teacher supply and teacher demand. In particular, wealthy communities are generally willing and able to pay higher salaries, but also are desirable places for teachers to work and thus should have negative compensating wages. Poorer communities may be willing but unable to pay high salaries, and

have characteristics that command positive compensating wages. To the extent that these effects offset each other, it can be difficult to measure accurately the differential that is due to compensating wages. This is a fundamental problem in other studies of compensating differentials, where the objective is the measurement of these implicit wages. However, the objective in this study is to look for *changes* in relative salaries before and after the imposition of the revenue limits. If we assume that teacher preferences are relatively stable over time, then changes in the coefficients of equation (2) are likely to reflect solely changes in districts' willingness or ability to pay for teachers.

To see this more explicitly, let the market for teachers be represented by the following district-level supply and demand equations (the district subscript is suppressed):

Supply: $\ln W_S = S_0 + S_x(\ln X) + S_q(\ln Q) - S_I(\ln I)$

Demand: $\ln W_D = D_0 + D_x(\ln X) - D_q(\ln Q)$

Here, I represents the income level of the students; X represents other characteristics of the teachers. The supply curve is inversely related to student income because teachers are assumed to be willing to work in wealthier districts for lower wages (since there are non-pecuniary benefits of teaching wealthier students). The compensating differential (i.e., the increased wage that low-income districts must pay simply because they are low-income) is (S_i * $\Delta \ln I$). In equilibrium, supply equals demand and we can solve for the following reduced-form wage equation:

$$\ln W = \alpha + \beta \ln X + \gamma \ln I$$

$$\alpha = \frac{S_0 D_q + S_q D_0}{S_q + D_q}, \beta = \frac{S_x D_q + S_q D_x}{S_q + D_q}, \gamma = \frac{S_i D_q}{S_q + D_q}$$

This reduced-form equation is equivalent to equation (2), with student income as the only nonwage job characteristic. Note that γ is a biased measure of the true compensating differential with the bias equal to D_q/S_q+D_q. Now let there be a policy change that causes a shift in the demand curve (such as a restriction on the district budget). That is, the demand equation now contains an extra term, D_pP, where P equals one when the policy is in place and zero otherwise:

Demand: $\ln W_D = D_0 + D_x(\ln X) - D_q(\ln Q) - D_pP$

The reduced-form equation is exactly the same as before but with an additional policy term:

$$\ln W = \alpha + \beta \ln X + \gamma \ln I + \lambda P, \lambda = \frac{S_q D_p}{S_q + D_q}$$

In this case, the estimated wage differential for income is still (biased) γ. But now let the policy affect demand differently across districts, depending on the income level. That is, let D_p be a function of income: $D_p = \varphi(\ln I)$. Then the reduced-form wage equation becomes:

$$\ln W = \alpha + \beta \ln X + \gamma \ln I + \lambda P = \alpha + \beta \ln X + \gamma \ln I + \frac{S_q \varphi \ln I}{S_q + D_q} P = \alpha + \beta X + \frac{S_i D_q + S_q \varphi P}{S_q + D_q} \ln I$$

The compensating differential for income is now a function of φ and P. If P equals one (i.e., the policy is in effect), and the estimated differential gets bigger, then φ must be positive, and the policy restricts demand in high-income districts more than low-income districts. If the estimated

differential gets smaller, then φ must be negative, and the policy restricts demand in low-income districts more than high-income districts.

To see this graphically, let District A be the preferred district (i.e., has positive attributes such as high income that lead teachers to prefer district A over district B) and thus, teachers demand a salary premium to work in district B. In Figure 1, districts A and B face different supply curves that depend on district characteristics.[12] The vertical distance between the supply curves is the true compensating differential ($S_i * \Delta \ln I$). But the measured wage differential will be the distance W_B-W_A, which is the biased measure γ.

Now imagine that teacher demand in both districts falls – for example, due to the revenue limits that restrict a district's ability to pay for teachers of any given quality – and the demand curves in Figure 1 shift in. If the curves for both districts shift by the same amount, there should be no change in the observed wage differential.[13] However, if D_B' falls more, then the observed wage differential will shrink; if D_A shifts in more, then the wage differential will grow. If we assume that teacher preferences have not changed (i.e., the supply curves have not moved) and district preferences have not changed (i.e., the only cause of the demand change is the policy restriction), then the direction of the change in the wage differential can tell us which district is more strongly restricted by the policy limits. Note that it does not matter that the wage differential is estimated with bias; in fact, in one sense, the object of interest is the change in that bias.

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[12] Note that although we usually think of supply and demand in terms of quantity, the number of teachers that a given district must hire is relatively fixed, based on student enrollment. However, districts can choose to hire teachers of different *quality* instead. If we think of the horizontal axis as quality, rather than quantity, the intuition is the same.

[13] For there to be no change in the differential when both demand curves shift together, we also need the assumption that the slope of teacher supply in both districts is the same over the range of the shift in demand (i.e., S_A and S_B are parallel).

The fall in demand means that either quality must fall or there will be a shortage. In particular, if wage variation decreases as districts respond to the policy constraints (e.g., demand in district B is constrained more than in district A), then teachers may be more likely to move out of districts that previously paid higher compensating wages for disagreeable characteristics – and indeed, for the last few years, teacher shortages have been a recurring problem in several Wisconsin districts.

The preceding discussion suggests that the nonwage job characteristics in J_j should measure those aspects of a job or district for which teachers may demand compensating wages. For this analysis of compensating wage differentials, I include several variables found in previous wage studies. Pupil-teacher ratio provides a proxy for class size, the expectation being that teachers prefer smaller classes (i.e., that smaller classes carry a lower workload) so that a higher ratio will be correlated with higher wages. The percent of students who are from economically disadvantaged backgrounds is typically considered to command positive implicit wages as these are likely to be more demanding students. Total student enrollment is also included, though it is difficult to predict, a priori, the sign of this coefficient. It could be that larger districts are desirable to teachers because there may be more support (i.e., aides, counselors, training programs, etc.); on the other hand, larger districts are likely to be more administratively bureaucratic. Three measures of the urban environment are also included. One is an indicator variable for Milwaukee. Milwaukee is unique in the state not only because of its large size (with enrollment over 100,000, it is four times larger than the next largest district), but the urban environment of Milwaukee is significantly different from other cities in the state. It is more comparable to urban centers elsewhere in the country, with high percentages of nonwhite

and low-income students and an inner city distinct from the suburbs. In addition to the Milwaukee indicator, dummy variables are included for other city districts and rural districts.

Eberts and Stone (1985) argue for the importance of including measures such as a district's financial state and bargaining strength, in part to reduce the bias due to demand effects. In the analysis here it is particularly important to control for possible shifts in demand that are due to changing tastes and not the policy limits. I therefore include the equalized property value per pupil and average teacher experience in the district.

Finally, the variables in X_i measure a teacher's human capital and include education (measured with a dummy variable that equals one if a teacher has a master's degree or higher) and experience.[14] Most human capital models also include the teacher's age and gender and these are also represented in X_i. It is important again to point out that in this analysis, X_i does not contain any measure of teacher quality.

In contrast to previous studies of compensating differentials, separate models are estimated for new and more experienced teachers. Almost all previous studies of compensating differentials use samples that include teachers of all levels (e.g., Antos and Rosen, 1975; Eberts and Stone, 1985; Baugh and Stone, 1982). However, Levinson (1988) points out that the labor market faced by new teachers is quite different from the market for more experienced teachers. Because of the rigid salary grid, a teacher's salary is not connected to her marginal product and the salary structure creates a strong disincentive for teachers to leave a district. The only way to increase one's salary is to accumulate seniority (or education credits, up to a point) and the only way to improve one's environment within a district is to transfer schools, which also requires

[14] For estimation with the sample of first-year teachers, the experience variable is omitted (as all teachers in the sample are in their first year of teaching so both total and local experience equal 1). For the sample of experienced

accumulating seniority. The tenure process also suggests that experienced teachers are willing to trade some amount of salary for job security (though this is less important during times of growing enrollment, such as the 1990's in Wisconsin, when layoffs are rare). The market for more experienced teachers is thus not subject to the same competitive pressures as the market for new teachers and the tradeoffs that older teachers are willing to make are likely to be different than for new teachers.

Table 6 shows the results of estimation of equation (2) for new teachers in 1992-93, 1995-96 and 1998-99; results for experienced teachers are shown in Table 7. Focusing first on new teachers, 1992-93 wages were higher in districts with high pupil-teacher ratios, high spending and property values, and the smallest and largest districts. There does not appear to be any statistically significant wage differential for Milwaukee or low-income students but with these variables, it is possible that supply and demand effects are canceling each other out (i.e., teachers demand a wage premium to teach in these districts but these are districts with low demand for teachers due to tastes or low budgets). Also, the coefficient on the Milwaukee indicator is somewhat misleading. Since Milwaukee is such a large outlier in terms of student enrollment, calculation of the Milwaukee wage premium should consider the enrollment relationship as well. In 1992-93, the relationship between salary and district size is quadratic and salaries fall with enrollment up to 1,170 students and then increase. The bottom of Table 6 shows that the predicted salary in 1992-93 for an average new teacher (female, age 30 with a B.A.) in an average district (i.e., the value of all district characteristics set at their means) is

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teachers, both district experience and additional non-district experience are included, with additional experience defined as the difference between total and local experience.

$23,043. All else equal,[15] the same teacher would make $26,360 in Milwaukee. That is, an average teacher demands at least an additional $3,317, or 14%, to teach in Milwaukee over an average district.[16]

In a similar way, we can calculate the predicted salary for an average teacher in a district with relatively few low-income students and compare this to the salary in a district with a relatively high proportion of low-income students. For a district at the tenth percentile of poor students, the predicted salary is $22,944; at the ninetieth percentile it is $23,087. This implies that teachers demand at least $143, or 0.6%, to move from a low-poverty district to a high-poverty district.

By 1998, the wage differential for new teachers in Milwaukee had fallen to 8.8%, suggesting that Milwaukee's demand curve has fallen relative to the average district. Similarly, the wage differential for districts with high percentages of poor students has fallen, so much so that it actually becomes negative. The predicted salary of a teacher in a low-poverty district is $22,805 and $22,472 in a high-poverty district, a negative differential of $333. One way to explain the negative coefficient on the percent of low-income students could be that between 1992-93 and 1998-99, teacher preferences changed so that teachers actually prefer to teach low-income students (i.e., in terms of Figure 1, the preferred district A is the poorer district, not the wealthy district). The more plausible explanation is that demand for teachers in poor districts is so low that this completely cancels out teacher preferences (i.e., in terms of Figure 1, district B is the poorer district but D_B' is so far below D_A that W_B' is less than W_A). The change in the wage

[15] All district characteristics are held constant at their mean values except student enrollment and the Milwaukee indicator variable.

[16] Milwaukee also has a very high percentage of low-income students, which could also affect the wage differential. When the percent of low-income students is also taken into account, Milwaukee's wage differential increases slightly to 15%.

differential between 1992-93 and 1998-99 thus suggests that high-poverty districts have been more constrained by the policy changes than low-poverty districts.

These observed changes in relative wages over time are consistent with the idea that the revenue limits and QEO law have constrained beginning salaries in Milwaukee and other high-poverty districts more than in other districts. Since relative wages are an important determinant of inter-district mobility, these results suggest that the policy changes may have been a contributing factor in the teacher shortages and higher teacher attrition that low-income districts have experienced in the last few years. The results also support the findings of Figlio and Reuben (1998) that the quality of beginning teachers fall under revenue limits and their assumption that this is due, in part, to lower salaries for beginning teachers.

The market for experienced teachers looks somewhat different. As with beginning teachers, the wage differential between low- and high-poverty districts goes from positive ($465 or 1.3%) to negative (-$564), suggesting that the relative wage for experienced teachers in low-income districts has fallen. However, in contrast to beginning teachers, experienced teachers in Milwaukee have seen their relative wages increase. The wage premium for experienced teachers in Milwaukee is $5099, or 13.7%, in 1992-93 and grows to $6108, or 15.7%, in 1998-99. This lends some credence to the idea of union rents – at least in Milwaukee, experienced teachers have been able to preserve their relative wages while beginning salaries have fallen.

VI. Conclusion

This study finds evidence that Wisconsin's school revenue limits and Qualified Economic Offering law have led to decreases in real salaries, particularly for high-salary districts and for beginning teachers relative to more experienced teachers. It appears that the policies

have had more restrictive effects in Milwaukee and other districts with high proportions of low-income students. This suggests that these policies may be playing a role in the teacher shortages that these districts have experienced in the last few years and may be adversely affecting teacher quality in these districts. Policymakers concerned about educational equity across districts may wish to consider revisions to the laws that will ease the constraints on districts that serve disadvantaged student populations. For example, exemptions from the revenue caps for districts with a certain percentage of low-income students, or changing the revenue cap to a percentage of the revenue base, rather than a fixed nominal dollar amount. This would allow districts that must pay compensating wages to maintain their relative wages.

There is also some support for one theory about why money does or does not matter for student outcomes. If teacher unions are able to extract rents for experienced teachers when spending increases, or push salary cuts onto inexperienced teachers when spending falls, then giving schools additional funds may not lead to better student performance but cutting funding may still lead to worse student performance. In Wisconsin, salaries for beginning teachers appear to be more adversely affected by the policy limits than salaries for experienced teachers, providing some evidence that the theory of union rents is justified.

Throughout this paper, the assumption has been that higher salaries attract higher quality teachers and thus, declining real salaries are detrimental to the quality of education for students. Future research should incorporate information on teacher quality and student outcomes to clarify the effect of revenue limits and the QEO law on students. However, even the analysis presented here, of salaries alone, gives us important insights into how these policies are affecting the teacher labor market in Wisconsin and suggests revisions to the policies may be needed.

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Figure 1

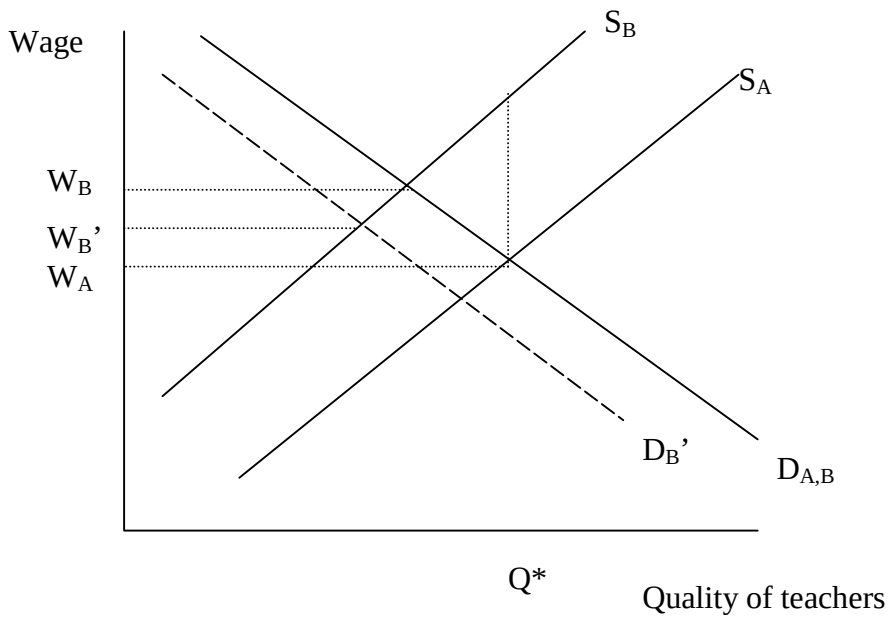

Table 1: Summary Statistics

standard deviations in parentheses

	1992-93		1995-96		1998-99	
New Teachers (Experience=1):						
N	1686		1696		2355	
Salary	$24,808.43	*(3955.48)*	$23,718.37	*(2883.38)*	$23,934.97	*(3120.67)*
Gender (1=female)	0.728	*(0.45)*	0.715	*(0.45)*	0.730	*(0.44)*
B.A. Degree	0.894	*(0.31)*	0.934	*(0.25)*	0.933	*(0.25)*
Advanced degree	0.106	*(0.31)*	0.066	*(0.25)*	0.067	*(0.25)*
Age	29.5	*(7.80)*	28.7	*(7.12)*	29.4	*(7.89)*
High school FTE	19.771	*(38.99)*	26.286	*(43.37)*	22.530	*(41.20)*
Average district experience	12.970	*(1.64)*	13.150	*(1.73)*	12.564	*(1.78)*
Experienced Teachers (Experience>20):						
N	11425		13107		13210	
Salary	$41,734.19	*(5328.75)*	$41,831.99	*(5063.58)*	$42,332.72	*(5176.19)*
Gender (1=female)	0.526	*(0.50)*	0.558	*(0.50)*	0.597	*(0.49)*
Local Experience	25.1	*(3.41)*	26.0	*(3.57)*	26.8	*(3.84)*
Total Experience	26.8	*(4.27)*	27.2	*(4.15)*	27.9	*(4.06)*
Non-district Experience	1.6	*(2.58)*	1.3	*(2.20)*	1.1	*(2.08)*
B.A. Degree	0.513	*(0.50)*	0.478	*(0.50)*	0.463	*(0.50)*
Advanced degree	0.487	*(0.50)*	0.522	*(0.50)*	0.537	*(0.50)*
Age	50.5	*(5.23)*	50.6	*(4.76)*	51.3	*(4.35)*
High school	31.487	*(45.93)*	33.346	*(46.74)*	31.283	*(45.97)*
Average district experience	13.937	*(1.65)*	14.123	*(1.81)*	13.809	*(1.96)*
District Characteristics:						
Enrollment	1896.91	*(5188.72)*	1991.92	*(5379.93)*	2037.43	*(5536.23)*
Percent eligible for free and reduced price lunch	21.4%	*(0.14)*	20.8%	*(0.14)*	20.5%	*(0.14)*
Pupil-teacher ratio	13.39	*(1.57)*	13.15	*(1.42)*	12.95	*(1.42)*
Per-pupil spending	$6,582.00	*(1202.79)*	$6,670.09	*(951.92)*	$7,313.93	*(1047.32)*
Milwaukee	0.002	*(0.05)*	0.002	*(0.05)*	0.002	*(0.05)*
Other city	0.040	*(0.20)*	0.040	*(0.20)*	0.040	*(0.20)*
Suburb	0.083	*(0.28)*	0.085	*(0.28)*	0.085	*(0.28)*
Town	0.327	*(0.47)*	0.324	*(0.47)*	0.324	*(0.47)*
Rural	0.550	*(0.50)*	0.549	*(0.50)*	0.549	*(0.50)*
Equalized property value per pupil	$242,855.79	*(273382)*	$290,191.86	*(311601)*	$361,412.14	*(383114)*
Number of districts	422		426		426	

Table 2: Average Salaries, 1990-1999

All values in 1992 dollars
standard deviations in parentheses

	90-91	91-92[1]	92-93	93-94[2]	94-95	95-96	96-97	97-98	98-99
Number of Districts	408	270	422	427	427	426	425	426	426
Minimum Salary	$22,565.90	$22,644.82	$22,559.20	$22,810.62	$22,844.13	$22,570.73	$22,316.30	$21,914.98	$22,279.26
	(2357.5)	(1868.4)	(1972.4)	(1693.6)	(1652.5)	(1613.4)	(1734.9)	(1610.8)	(1526.6)
% annual change		0.35%	-0.38%	1.11%	0.15%	-1.20%	-1.13%	-1.80%	1.66%
Maximum Salary	$43,297.82	$43,915.68	$42,729.08	$43,257.17	$43,041.77	$42,782.85	$42,578.34	$42,152.68	$43,231.46
	(5953.9)	(6610.1)	(5944.5)	(6406.4)	(5698.7)	(5737.3)	(5460.1)	(5412.3)	(5491.0)
% annual change		1.43%	-2.70%	1.24%	-0.50%	-0.60%	-0.48%	-1.00%	2.56%
Average Salary	$33,517.19	$34,003.38	$33,584.00	$33,986.99	$34,028.30	$33,684.96	$33,441.79	$32,963.09	$33,535.08
	(3493.5)	(3744.3)	(3336.9)	(3433.0)	(3350.9)	(3296.1)	(3302.6)	(3292.7)	(3288.0)
% annual change		1.45%	-1.23%	1.20%	0.12%	-1.01%	-0.72%	-1.43%	1.74%
Per-job wage and salary disbursements	$21,941.33	$21,810.37	$22,353.00	$22,292.65	$22,431.91	$22,535.46	$22,720.73	$23,330.01	$23,987.86
% annual change		-0.60%	2.49%	-0.27%	0.62%	0.46%	0.82%	2.68%	2.82%

[1] Averages were also calculated using only those districts with data available in every year. Qualititative results were fairly similar except that the magnitudes of % annual change in 91-92 and 92-93 were smaller in all cases.

[2] 1993-94 was the first year of revenue limits; it was also the first year of the QEO law but not all districts settled contracts under the new law

Table 3: Annual Change in Salaries

	91-92	92-93	93-94*	94-95	95-96	96-97	97-98	98-99
Number of Districts	270	422	427	427	426	425	426	426
Minimum Salary	0.35%	-0.38%	1.11%	0.15%	-1.20%	-1.13%	-1.80%	1.66%
Low-income students:								
10th percentile	-1.73%	-2.91%	0.53%	1.52%	-1.93%	-2.53%	-0.59%	1.47%
90th percentile	1.80%	2.50%	-1.41%	0.76%	-0.59%	0.88%	-2.46%	0.98%
Per-pupil spending:								
10th percentile	-1.28%	1.37%	1.63%	-0.79%	-1.00%	-0.73%	-1.64%	3.03%
90th percentile	0.12%	0.68%	3.22%	0.75%	-1.13%	-0.68%	-1.68%	1.04%
Minimum salary:								
10th percentile	6.76%	9.86%	9.34%	5.13%	3.00%	2.90%	3.23%	9.07%
90th percentile	-6.88%	-4.63%	-6.77%	-6.45%	-4.74%	-6.71%	-8.48%	-3.90%
Equalized property value per pupil:								
10th percentile			0.22%	0.49%	-1.17%	-0.34%	-1.43%	2.35%
90th percentile			0.97%	-0.26%	-1.61%	-0.80%	-1.99%	-0.12%
Maximum Salary	1.43%	-2.70%	1.24%	-0.50%	-0.60%	-0.48%	-1.00%	2.56%
Low-income students:								
10th percentile	1.92%	-0.52%	1.00%	0.02%	-1.10%	-0.07%	-1.43%	1.85%
90th percentile	1.05%	4.55%	-0.28%	0.33%	-0.87%	-0.09%	-0.21%	3.74%
Per-pupil spending:								
10th percentile	0.50%	2.37%	0.14%	-0.43%	0.88%	0.05%	-1.55%	3.82%
90th percentile	1.27%	0.02%	1.36%	0.12%	-1.77%	0.20%	-0.70%	2.18%
Maximum salary:								
10th percentile	2.40%	11.90%	8.00%	0.98%	-0.18%	0.59%	-0.79%	4.12%
90th percentile	-0.59%	-4.79%	-1.86%	-4.47%	-1.79%	-3.03%	-3.40%	-0.17%
Equalized property value per pupil:								
10th percentile			3.05%	-1.02%	-0.81%	-0.16%	-1.94%	2.31%
90th percentile			2.22%	0.67%	-0.86%	-0.63%	-1.09%	2.18%
Average Salary	1.45%	-1.23%	1.20%	0.12%	-1.01%	-0.72%	-1.43%	1.74%
Low-income students:								
10th percentile	0.41%	-0.36%	0.21%	0.61%	-1.70%	-0.64%	-1.72%	1.19%
90th percentile	1.06%	2.62%	-0.03%	0.67%	-0.95%	-0.79%	-1.06%	1.58%
Per-pupil spending:								
10th percentile	0.88%	0.94%	0.91%	-0.24%	-1.02%	-0.31%	-1.42%	2.20%
90th percentile	0.44%	0.36%	1.83%	0.12%	-1.56%	-0.68%	-1.37%	1.25%
Average salary:								
10th percentile	1.71%	8.08%	5.29%	1.65%	-0.31%	-0.24%	-0.31%	2.90%
90th percentile	-0.52%	-2.77%	-0.04%	-0.75%	-1.86%	-0.98%	-1.74%	0.92%
Equalized property value per pupil:								
10th percentile			0.35%	0.29%	-0.72%	-0.27%	-1.63%	1.71%
90th percentile			1.34%	-0.17%	-1.39%	-0.50%	-1.24%	1.08%

Table 4: Fixed Effects Estimation, Minimum Salaries

Minimum Salaries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Limits indicator	0.006	0.009	0.009	0.130 *	-0.026 **	3.77 *	0.153	3.69 *	3.68 *	3.89 *
	(0.007)	*(0.007)*	*(0.007)*	*(0.039)*	*(0.016)*	*(0.24)*	*(0.113)*	*(0.25)*	*(0.25)*	*(0.27)*
Limits x Milwaukee			-0.048						-0.038	-0.020
			(0.040)						*(0.038)*	*(0.040)*
Limits x 1992 EQV/pupil				-0.010 *						
				(0.003)						
Limits x 1992 Enrollment					0.0051 *					-0.004
					(0.002)					*(0.002)*
Limits x 1992 Minimum salary						-0.375 *		-0.379 *	-0.379 *	-0.39 *
						(0.024)		*(0.024)*	*(0.024)*	*(0.025)*
Limits x 1992 spending/pupil							-0.016	0.013	0.014	0.008
							(0.013)	*(0.013)*	*(0.013)*	*(0.013)*
Enrollment		-0.120 *	-0.121 *	-0.107 *	-0.120 *	-0.102 *	-0.120 *	-0.103 *	-0.103 *	-0.102 *
		(0.020)	*(0.020)*	*(0.021)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*
Percent low-income		-0.002	-0.002	-0.002	-0.003	-0.007 *	-0.002	-0.007 *	-0.007 *	-0.006 *
		(0.003)	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*
Effect of limits at means				0.005	0.012	0.007	0.008	0.007	0.007	0.004
10th percentile 1992 Salaries						0.044		0.045	0.045	0.043
90th percentile 1992Salaries						-0.024		-0.024	-0.024	-0.028
Milwaukee			-0.039							-0.032

* Statistically significant at the 5% level

** Statistically significant at the 10% level

All specifications also include time and district fixed effects

Table 5: Fixed Effects Estimation, Maximum Salaries

Maximum Salaries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Limits indicator	0.01	0.009	0.009	-0.070 **	0.048 *	1.48 *	-0.018	1.33 *	1.40 *	1.58 *
	(0.007)	*(0.007)*	*(0.007)*	*(0.039)*	*(0.015)*	*(0.16)*	*(0.112)*	*(0.18)*	*(0.18)*	*(0.19)*
Limits x Milwaukee			0.101 *						0.150	0.122
			(0.039)						*(0.039)*	*(0.040)*
Limits x 1992 EQV/pupil				0.007						
				(0.003)						
Limits x 1992 Enrollment					-0.006					0.009 *
					(0.002)					*(0.003)*
Limits x 1992 Maximum salary						-0.138 *		-0.142 *	-0.149 *	-0.186 *
						(0.015)		*(0.015)*	*(0.015)*	*(0.019)*
Limits x 1992 spending/pupil							0.003	0.021 **	0.021 **	0.040 *
							(0.013)	*(0.013)*	*(0.013)*	*(0.014)*
Enrollment		0.039 **	0.040 *	0.030	0.039 **	0.056 *	0.039 **	0.056 *	0.058 *	0.062 *
		(0.020)	*(0.020)*	*(0.021)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*	*(0.020)*
Percent low-income		-0.012 *	-0.012 *	-0.012 *	-0.011 *	-0.010 *	-0.012 *	-0.010 *	-0.010 *	-0.011 *
		(0.003)	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*	*(0.003)*
Effect of limits at means				0.012	0.005	0.005	0.009	0.006	0.005	0.012
10th percentile 1992 Salaries						0.027		0.028	0.029	0.041
90th percentile 1992Salaries						-0.019		-0.019	-0.020	-0.020
Milwaukee			0.110							0.137

* Statistically significant at the 5% level

** Statistically significant at the 10% level

All specifications also include time and district fixed effects

Table 6: Compensating Wage Estimation for Beginning Teachers

Dependent variable = log of salary
All dollar values in 1992 dollars

	1992-93	1995-96	1998-99
Gender (1=female)	-0.0141 *	-0.0084 **	-0.0056
	(0.005)	*(0.005)*	*(0.004)*
Advanced degree (1=Master's or higher)	0.1529 *	0.1475 *	0.1606 *
	(0.008)	*(0.009)*	*(0.007)*
High school (1=teaches grades 9-12)	-0.0059	0.0100 *	0.0126 *
	(0.006)	*(0.005)*	*(0.004)*
Age	0.0055 *	0.0047 *	0.0042 *
	(0.000)	*(0.000)*	*(0.000)*
Cost of living index	0.0013	0.0013	0.0009
	(0.001)	*(0.001)*	*(0.001)*
Log of student enrollment	-0.0652	0.1762 *	0.0844 *
	(0.041)	*(0.036)*	*(0.032)*
Square of log of student enrollment	0.0046 **	-0.0119 *	-0.0053 *
	(0.003)	*(0.002)*	*(0.002)*
Log of percent low-income students	0.0030	-0.0036	-0.0070 *
	(0.004)	*(0.005)*	*(0.003)*
Milwaukee	0.0461	0.2695 *	0.1538 *
	(0.044)	*(0.038)*	*(0.034)*
Other city	0.0231 **	0.0872 *	0.0451 *
	(0.014)	*(0.011)*	*(0.010)*
Rural	0.0087	-0.0001	0.0030
	(0.008)	*(0.007)*	*(0.006)*
Pupil-teacher ratio	0.0111 *	0.0011	0.0112 *
	(0.002)	*(0.002)*	*(0.002)*
Log of equalized property value per pupil	0.0341 *	0.0196 *	0.0183 *
	(0.009)	*(0.008)*	*(0.006)*
Intercept	9.4090 *	8.8801 *	9.1364 *
	(0.201)	*(0.190)*	*(0.153)*

* Statistically significant at the 5% level

** Statistically significant at the 10% level

Predicted salary for average teacher:		
Average district	$23,043	$22,572
Milwaukee	$26,360	$24,566
Differential	$3,317	$1,993
Low-income 10th percentile	$22,944	$22,805
Low-income 90th percentile	$23,087	$22,472
Differential	$143	-$333

Table 7: Compensating Wage Estimation for Experienced Teachers

Dependent variable = log of salary
All dollar values in 1992 dollars

	1992-93	1995-96	1998-99
Gender (1=female)	-0.0130 *	-0.0068 *	-0.0021
	(0.002)	*(0.001)*	*(0.001)*
District experience	0.0011 *	0.0012 *	0.0019 *
	(0.000)	*(0.000)*	*(0.000)*
Non-district experience	0.0005	0.0002	0.0012 *
	(0.000)	*(0.000)*	*(0.000)*
Advanced degree (1=Master's or higher)	0.1199 *	0.1163 *	0.1163 *
	(0.002)	*(0.001)*	*(0.001)*
High school (1=teaches grades 9-12)	0.0087 *	0.0101 *	0.0085 *
	(0.002)	*(0.002)*	*(0.002)*
Age	0.0000	-0.0001	-0.0002
	(0.000)	*(0.000)*	*(0.000)*
Cost of living index	0.0045 *	0.0035 *	0.0051 *
	(0.000)	*(0.000)*	*(0.000)*
Log of student enrollment	0.1000 *	0.2289 *	0.2142 *
	(0.013)	*(0.012)*	*(0.011)*
Square of log of student enrollment	-0.0038 *	-0.0126 *	-0.0118 *
	(0.001)	*(0.001)*	*(0.001)*
Log of percent low-income students	0.0060 *	-0.0075 *	-0.0069 *
	(0.001)	*(0.002)*	*(0.001)*
Milwaukee	0.0206 **	0.1842 *	0.1916 *
	(0.012)	*(0.011)*	*(0.011)*
Other city	0.0175 *	0.0342 *	0.0357 *
	(0.004)	*(0.003)*	*(0.003)*
Rural	-0.0035	-0.0140 *	-0.0198 *
	(0.002)	*(0.002)*	*(0.002)*
Average district experience	0.0087 *	0.0072 *	0.0051 *
	(0.001)	*(0.000)*	*(0.000)*
Pupil-teacher ratio	0.0066 *	0.0023 *	0.0048 *
	(0.001)	*(0.001)*	*(0.001)*
Log of equalized property value per pupil	0.0689 *	0.0711 *	0.0604 *
	(0.003)	*(0.002)*	*(0.002)*
Intercept	8.4520 *	8.1799 *	8.1924 *
	(0.063)	*(0.061)*	*(0.058)*

* Statistically significant at the 5% level

** Statistically significant at the 10% level

Predicted salary for average teacher:		
Average district	$37,355	$38,889
Milwaukee	$42,454	$44,997
Differential	$5,099	$6,108
Low-income 10th percentile	$37,033	$39,283
Low-income 90th percentile	$37,498	$38,719
Differential	$465	-$564

Appendix

ALMA DISTRICT SALARY SCHEDULE 1994 -1995

$22,975 BASE SALARY

$655 STEP INCREMENT

$20 ADDITIONAL STEP INCREMENT MS+ LANES

$850 LANE INCREMENTS

	BS	BS+8	BS+16	BS+24	MS	MS+8	MS+16
1	22,975	23,825	24,675	25,525	26,375-	27,225	28,075
2	23,630	24,480	25,330	26,180	$27,030	$27,900	$28,750
3	24,285	25,135	25,985	26,835	$27,685	$28,575	$29,425
4	24,940	25,790	26,640	27,490	$28,340	$29,250	$30,100
5	25,595	26,445	27,295	28,145	$28,995	$29,925	$30,775
6	26,250	27,100	27,950	28,800	$29,650.	$30,600	$31,450
7	26,905	27,755	28,605	29,455	$30,305	$31,275	$32,125
8	27,560	28,410	29,260	30,110	$30,960	$31,950	$32,800
9	28,215	29,065	29,915	30,765	$31,615	$32,625	$33,475
10	28,870	29,720	30,570	31,420	$32,270	$33,300	$34,150
11	29,525	30,375	31,225	32,075	$32,925	$33,975	$34,825
12	30,180	31,030	31,880	32,730	$33,580	$34,650	$35,500
13		31,685	32,535	33,385	$34,235	$35,325	$36,175
14			33,190	34,040	$34,890	$36,000	$36,850
15				34,695	$35,545	$36,675	$37,525
16					$36,200	$37,350	$38,200
17						$38,025	$38,875
18							$39,550

LONGEVITY FOR MS + 16 LANE $40,050