Economic Aspects of the Demand for Teacher Quality

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July 2010

Paper prepared for the *Economics of Education Review*

* Stanford University, University of Texas at Dallas, National Bureau of Economic Research, and CESifo. Valuable research assistance was provided by Lorra de la Paz. This is a revised version of a paper originally prepared for the Conference on "Merit Pay: Will it Work? Is it Politically Viable?" sponsored by Harvard's Program on Education Policy and Governance, Taubman Center on State and Local Government, Harvard's Kennedy School, 2010.

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By Eric A. Hanushek

It has become widely accepted that teachers are the most important element of schools, but this recognition has not led to any consensus on the appropriate policies that should be followed to ensure that we have a good stock of teachers. The policy proposals range quite broadly, although generally they go either to the end of the spectrum calling for closer regulation of quality or to the end of greater economic incentives with little in between the two poles. At the same time, it is remarkable that these policy deliberations seldom include even the most rudimentary economic analyses or evaluations. The focus of most analysis of schools is simply whether or not some input has a significant positive impact on student achievement and not anything about what it might cost or what the benefits might be from deploying it. This paper focuses on the demand side of teacher quality in the United States and provides baseline estimates for the economic value of improving teacher quality.

Much of the discussion about the potential demand for teachers is framed in terms of ensuring sufficient numbers of trained teachers. This, however, is not really the issue, because we have for a long time trained considerably more teachers than the number of positions that annually become open in schools. For example, in 2000 86,000 recent graduates entered into teaching, even though 107,000 graduated with an education degree the year before (see Provasnik and Dorfman (2005), U.S. Department of Education (2009)).[1] At the same time, many

[1] Note that the recently graduated group entering teaching also includes a number of people who graduate with degrees other than in education, making the excess supply of education graduates even larger. Similar differentials existed throughout the 1990s, implying that the stock of trained teachers not in the teaching profession is substantial.

have noted particular shortages, such as math and science teachers or special education teachers. What usually gets left out is anything to do with quality (except perhaps the numbers lacking full teacher certification). This analysis is built on a simple premise: The key element is teacher quality. In turn, the demand for teacher quality is derived from the impact of teachers on student outcomes. Little thought is given to the economic value of outcomes, generally relying on the vague notion that higher scores on tests are better than lower scores, but this analysis puts outcome gains in economic perspective.

The basic estimates of the relevant achievement and pay-off parameters are in fact available in the literature. Moreover, the key parameters have been consistently estimated across different studies and with considerable precision. The innovation of this paper is to bring the existing work on parameter estimates together to produce plausible ranges for the underlying demand for teacher quality.

This paper begins with discussion of an overview of what is known about the relationship between teacher quality and student achievement. It then discusses the policy alternatives that have been pursued as a motivation for considering performance based policies. The central part of the paper is consideration of the derived demand for teachers that comes from their impact on economic outcomes.

The Central Importance of Teachers

Literally hundreds of research studies have focused on the importance of teachers. Two key findings emerge from all of these studies. First, teachers are very important. No other measured aspect of schools is nearly as important in determining student achievement. Second, it is not possible to identify specific characteristics of teachers that are reliably related to student

outcomes. Understanding these findings is central to the subsequent discussions of policies and the underlying economics of the proposed policies.

The general finding about the importance of teachers comes from the fact that the gains in learning across classrooms, even classrooms within the same school, are very different. [2] Some teachers year after year produce larger gains in students that other teachers. The magnitude of the differences is truly large, where some teachers have been found to get 1½ years of gain in achievement in an academic year, while others with equivalent students have been found to get ½ year of gain.[3] In other words, two students starting at the same level of achievement can know vastly different amounts at the end of a single academic year. If a bad year comes early in schooling or if a bad year is compounded by other bad years, it may not be possible for the student to recover.

No other attribute of schools comes close to having this much influence on student achievement. The available estimates, say, for class size reduction do not suggest continuing leverage through school, and the expected effects are small and fleeting.[4]

The related issue is what makes for an effective or ineffective teacher. The extensive research addressing this has found little that consistently distinguishes among teachers in their classroom effectiveness. Most documented has been the finding that master's degrees bear no consistent relationship with student achievement.[5] But other findings are equally as interesting

[2] For a summary and evaluation of value-added studies that look at the influence of teachers on achievement gains, see Hanushek and Rivkin (2010).

[3] Hanushek (1992) finds differences of this magnitude for disadvantaged students found in Gary, IN. For an overview of the results of similar studies, see Hanushek and Rivkin (2010).

[4] Most of the controversy about the impacts of class size focus on whether there is any discernible impact on student achievement (see, for example, Hanushek (1999), Ehrenberg, Brewer, Gamoran, and Willms (2001), Mishel and Rothstein (2002)). Much less attention has focused on the magnitude of any effects or the costs of any reductions. These issues come back into the discussion below.

[5] See the discussions in Hanushek and Rivkin (2004, (2006)

and important. The amount of experience in the classroom – with the exception of the first few years – also bears no relationship to performance. On average, a teacher with five years experience is as effective as a teacher with 25 years of experience. But, this general result about measured characteristics of teachers goes even deeper with little evidence that conventional teacher certification, that source of teacher training, or that level of salary are systematically related to the amount of learning that goes on in the classroom.[6]

The exception as noted is that during the first one to three years of teacher experience the typical teacher will get better at her job. She will develop her craft, learn her tasks, and find ways to help students learn. The existing evidence does not, however, suggest any clear way to provide this experience before entry into the classroom or to alter significantly the adjustments that should be made once in the classroom. For example, changes in the teacher preparation or more extensive induction and mentoring programs, while plausible policies, have yet to be shown to significantly alter the early career learning of teachers.[7] Similarly, even very intensive professional development has shown little impact on student achievement.[8]

The importance of teacher quality has some direct implications for the pay of teachers. The most important implication to an economist is that we want to pay sufficient salaries to ensure that there are high quality teachers in all classrooms. Salaries are viewed as a way of providing incentives to attract and retain the teacher force that we need as a country. This conclusion, however, is not as straightforward as it sounds, given the current structure of schools

[6] See, for example, the analyses of different preparation and entry routes into teaching in Boyd et al. (2006) and Kane, Rockoff, and Staiger (2008).

[7] See the experiments in Isenberg et al. (2009). This study compares a comprehensive induction and mentoring program to "business as usual" and finds no gains.

[8] Garet et al. (2008), Garet et al. (2010).

and labor markets for teachers and given limitations on understanding of how to identify effective teachers.

Problems with Current Teacher Policies

The appeal of performance pay schemes comes in large part from the lack of appeal of common alternatives. The general set of policies about teacher demand has combined a regulatory approach for the requirements to enter teaching and a political bargaining over salaries. Nonetheless, current teacher policies and the extensions of them that have been proposed have not proved effective in ensuring quality teachers in the classroom.

Most discussion of policy toward teachers include very limited attention to costs except where salary is itself the focus of discussion. In these latter discussions of salaries, moreover, little attention is given to effectiveness. Performance pay has not received extensive evaluation, because the use of such schemes has been limited and thus because the ability to study aspects of alternative pay systems has been limited.[9]

Current Certification Policies

Today's policies toward teachers begin with regulating who can enter teaching through a certification process that specifies entry requirements. Yet, existing evidence indicates that using regulatory approaches to obtaining "good teachers" is extraordinarily difficult, if not impossible. The analyses of teacher characteristics give us little reason to believe that we know enough about good teachers to set appropriate training and hiring standards. Specifically, the underlying idea behind most certification requirements is that we can ensure that nobody gets a bad teacher, i.e.,

[9] The use of performance pay has been increasing in the United States (Podgursky and Springer (2007)). Additionally, international experimentation has led to more recent analyses (see, for example, Lavy (2009) and Muralidharan and Sundararaman (2009)). Given the level of activity in this area, information about the supply side of the market is likely to increase rapidly.

that is possible to put a floor on quality. But doing this requires knowledge of characteristics that systematically affect performance. Credentials, degrees, experience, and even teacher test scores are not consistently correlated with teaching skill.[10] Thus, requirements that only fully certified teachers can enter the classroom – such as included in federal accountability legislation (No Child Left Behind Act, or NCLB)– may have little impact on student performance, even if achieved.

Nonetheless, some policy proposals argue for strengthening credentials, i.e., to make the standards higher and more rigorous. For example, some propose ensuring that *all* certified teachers have a master's degree (National Commission on Teaching and America's Future (1996)). Indeed, five states including New York currently require teachers to have an earned master's degree in order to receive permanent certification.[11] But, since past evidence shows teachers with a master's degree are not on average more effective than teachers lacking such a degree, these proposals to tighten up on what is required would raise the cost of becoming a teacher without a strong expectation that quality would improve.

Heightened screens for entry into teaching are also likely to be very costly. Tightening up on the entry requirements of entry into teaching typically involves increased course requirements in undergraduate school, perhaps requirements for a master's degree before entering into teaching, and higher test score requirements for entry into teacher training or for certification. Each of these makes entry into teaching relatively more costly than today. Other

[10] Some attention has focused on teacher test scores as a potential indicator of teacher quality. The existing empirical evidence suggests that these scores, when available, are more correlated with student achievement than other explicit measures of teacher characteristics (Hanushek (2003)). Nonetheless, the relationship is modest with less than half of the estimated parameters of teacher tests on student outcomes are statistically significant and with little of the underlying variation in teacher effectiveness can be accounted for by tests.

[11] An additional 11 states require master's for optional advanced licenses. See National Council on Teacher Quality (2009).

things equal, this would reduce the supply of potential teachers, leading mainly to altered choices among existing potential teachers. Of course salary increases could offset any alterations in supply. The magnitude of the needed increase would depend on the responsiveness of prospective teachers to salary changes – something about which we currently have only rudimentary knowledge.

A variety of experiments with alternative routes to teaching have gone beyond traditional certification. Indeed, a large portion of current teachers do not come through traditional teacher training institutions (Walsh and Jacobs (2007)). While these programs and their requirements vary widely, they do open the door to a broader range of training. The existing evidence on their success or failure is nonetheless limited. Two careful study of the performance of the Teach for America program shows generally positive results for math and equal results for reading when compared to traditionally trained teachers (see Raymond, Fletcher, and Luque (2001), Decker, Mayer, and Glazerman (2004)). Further, Boyd et al. (2006) and Kane, Rockoff, and Staiger (2008) look at different entry routes into teaching in New York City and find little average difference in effectiveness. [12] These results do, however, cast doubt on the idea of improving teacher quality by building on the existing traditional certification requirements.

Current Salary Policies

The second important aspect of teacher labor markets is the salaries that are paid. Salaries in private markets are roughly related to the economic value that is put on different workers. With some exceptions, most people view the overall pattern across the economy as matching what seems reasonable when thinking about the jobs they perform.

[12] Kane, Rockoff, and Staiger (2008) additionally provide some idea of the cost-trade-off of different teacher selection policies. They evaluate much more stringent retention programs based on value-added information.

Economists interpret this alignment of salaries and productivity of individuals as a natural outgrowth of having a competitive economy. If one firm does not pay a worker a salary that matches her value in terms of output, another competitive firm would pay that amount. If the firm pays the worker too much for her value, it will not be competitive with other firms and will be prone to going out of business.

Teacher labor markets, however, differ. Salaries are determined by collective bargaining between teachers' organizations and their employing school districts. School districts are not prone to going out of business if they pay the wrong amount.[13] But, being public activities, schools are always subject to political forces, and the goals for quality of schools depend on governmental decision making. As a result, teacher salary decisions are only partially driven by the economic forces that underlie salary determination in private, competitive industries.

Perhaps the most noticeable aspect of recent patterns of teacher salaries is that they have fallen so dramatically over time in relation to the rest of the economy. The changing position of teachers is clear in changes of salaries since the beginning of World War II. Compared to the earnings of college graduates, the average male teacher was slightly above the 50th percentile in 1940. The average female teacher was close to the 70th percentile. But then male teachers fell precipitously to the bottom third of the earnings distribution for college graduates, and female teachers were below average during the 1960s and close to the relative male position by 1990.[14]

This movement in salaries is mirrored by other measures. While somewhat difficult to trace general measures of achievement and ability over time, it appears that teachers are drawn

[13] Additionally, there are questions about whether the negotiations between school boards and teacher unions are arms-length transactions. See the various discussions in Howell (2005) and particularly Moe (2005).
[14] Hanushek and Rivkin (2006).

from deeper in the group of people going to college and that the best college graduates are not the ones going into teaching.[15]

Some analysts have focused on the current position of teachers in the wage/ability distribution as a fundamental issue driving student outcomes. Barber and Mourshed (2007), for example, identify the fact that Finland and South Korea attract top graduates into teaching as a key ingredient to their success on international tests. The source of this recruiting success is, however, less clear, because the high salaries for teachers are not found in Finland (but are found in Korea).

The potential costs of returning U.S. teachers to their former position in the salary structure are clearly enormous. While some have suggested that this would be a reasonable policy, no analysis is available to indicate what gains in teacher quality would result.

Two factors appear to be important in explaining these salary trends. First, by most accounts the skills needed to be an effective teacher are not necessarily those needed to be successful elsewhere in the economy. While there is uncertainty in this statement because we do not have any clear description of what skills are needed to be an effective teacher, we do not find for example that pure achievement-ability is all that closely related to student outcomes although it is closely related to earnings elsewhere in the economy. [16]

Second, the current structure of teacher pay appears to hold down teacher salaries. The single salary structure that pays all teachers (with the same experience and degree level) the same amount almost certainly acts to restrain the pay of teachers. Since salary contracts are largely political compromise with little discipline from the market, politicians negotiating

[15] Hanushek and Pace (1995), Corcoran, Evans, and Schwab (2002), Bacolod (2007).

[16] Hanushek (2003)

salaries must be able to defend the idea that salary increases are related to improved student outcomes. But, under the single salary schedule, teachers (with the same experience and graduate training) receive the same pay and increase, regardless of the teacher's effectiveness. This situation makes large salary increases difficult when the factors that determine pay are unrelated to teacher effectiveness in the classroom.

Certainly higher levels of salaries would tend to increase the pool of potential teachers, but the impact of that on overall teacher quality depends on the ability of principals and human resource teams in districts to choose the best teachers. Existing evidence, while not definitive, suggests that schools are not very effective at choosing the best teachers (Ballou (1996), Ballou and Podgursky (1997)).

A variant of policy discussions about salaries is to argue that the right way to set the salaries of teachers is to use the market salary for professionals in the open economy. At its heart this is simply one notion of how to determine a salary level, but it is generally unrelated to any arguments about the relative advantages and disadvantages of alternative occupations. To the extent that the overall compensation levels of teachers would be raised by this, it is subject to the same discussion at the previous arguments about restoring relative pay.

There is one aspect of this that has specific relevance, however. It is unclear precisely which professional occupations would provide the appropriate comparison. If the standard is privately employed professionals – say, lawyers, doctors, and accountants in private employment – a feature of the comparison is the overall structure of employment. Most private professionals have their salaries set much more in line with their individual productivity, so that these occupations have much large discrepancies in salaries and have noticeably higher employment

risks than are found in teaching. Thus, even if the comparison set of alternative professions were clear, the appropriate way to compare salaries under different employment conditions is not.

A significant feature of the existing salary discussions, however, is the absence of any linkage to quality as seen through student outcomes. Certainly discussions of quality are used to motivate most of the salary considerations, but little of the existing analysis is very relevant.

What Can Be Paid for Quality Teachers

An alternative way to think of feasible salaries for teachers is to consider the derived demand for quality teachers. The demand for teachers is derived from the demand for their product – educated students. For the most part, teacher demand has never been evaluated in terms of the potential gains for students in terms of the economic value of better performance. From this, some idea might be gained about what society should be willing to pay for higher effective teachers.

The Demand Side Based on Expected Student Earnings

Consider the economic returns to a student of having greater cognitive skills. The basics come from alternative estimates of the earnings gains from increased skills. Three U.S. studies provide very consistent estimates of the impact of test performance on earnings of young workers (Mulligan (1999); Murnane, Willett, Duhaldeborde, and Tyler (2000); Lazear (2003)). These studies employ different nationally representative data sets that follow students after they leave school and enter the labor force. When scores are standardized, they suggest that one

standard deviation increase in mathematics performance at the end of high schools translates into 10-15 percent higher annual earnings.[17]

Murnane, Willett, Duhaldeborde, and Tyler (2000) provide evidence from the High School and Beyond and the National Longitudinal Survey of the High School Class of 1972. Their estimates suggest some variation with males obtaining a 15 percent increase and females a 10 percent increase per standard deviation of test performance. Lazear (2003), relying on a somewhat younger sample from NELS88, provides a single estimate of 12 percent. These estimates are also very close to those in Mulligan (1999), who finds 11 percent for the normalized AFQT score in the NLSY data. Note that these returns can be thought of as how much earnings would increase with higher skills every year throughout the persons' working career. The estimates do, however, come early in the worker's career, suggesting the impact may actually rise with experience.[18]

In a different set of estimates using data on a sample of workers for the U.S., Hanushek and Zhang (2009) provide estimates of returns of 20 percent per standard deviation. One distinguishing feature of these estimates is that they come for a sample of workers throughout the career, as opposed to the prior estimates that all come from early-career earnings.[19] Using yet another methodology that relies upon international test scores and immigrants into the U.S.,

[17] It is convenient to convert test scores into measures of the distribution of achievement across the population. A separate review of the normalized impact of measured cognitive skills on earnings by Bowles, Gintis, and Osborne (2001) finds that the mean estimate is only 0.07, or slightly over half of the specific studies here.

[18] Altonji and Pierret (2001) consider the possibility of statistical discrimination that leads to increased returns to cognitive skills over time. Specifically, when young workers first go to an employer, it is difficult for the employer to judge the skills of the worker. Over time, the employer can more accurately assess the skills of the worker, and, if worker skills are related to cognitive skills as measured by the tests, the returns to test scores will rise with experience. Their analysis supports this idea, with the returns to cognitive skills rising and the returns to school attainment falling with labor market experience. When the model was tested across countries, however, it seemed most important for the United States but not for other countries (see Hanushek and Zhang (2009)).

[19] The data from the International Assessment of Adult Literacy (IALS) provide both tests of reading and numeracy skills but also assess a range of adult workers. The estimates in Hanushek and Zhang (2009) come, like the previously mentioned studies, from adding cognitive skills to a standard Mincer earnings function.

Hanushek and Woessmann (2009) obtain an estimate of 14 percent per standard deviation. They find that skills measured by international math and science tests from each immigrant's home country are significant in explaining earnings within the United States.[20]

The finding that moving a standard deviation in cognitive skills yields 10-15 percent higher income may sound small, but these increments apply throughout the lifetime. In 2010, the average present value of income for fulltime, full-year workers age 25-70 is $1.16 million.[21] Thus, one standard deviation higher performance amounts to over $150,000.

Given the returns to higher cognitive skills, it is useful to merge evidence about variations in teacher effectiveness with the impact on performance. A teacher who is 0.5 s.d. above average in the teacher effectiveness distribution (i.e., at the 69th percentile) would, according to the above estimates, lead to a 0.1 s.d. improvement in cognitive skills (assuming that the standard deviation of teacher effectiveness in units of student achievement is 0.2 s.d.).[22] Combining the improvement in scores for an individual with the impact on future earnings a present value of $10,600 over a lifetime of work.

But this is not the impact of the teacher. The impact on one student is replicated in the other students in the class. Thus, calculation of the impact of a teacher depends directly on class size. Figure 1 show the impact of different quality teachers by class sizes. A teacher who is at the 60th percentile (0.25 s.d. above average) raises individual earnings by $5,292, and this

[20] This analysis begins with a standard Mincer earnings models but estimates the returns to skills from a difference-in-differences formulation based on whether the immigrant was educated in the home country or in the United States.

[21] Calculations use average income by age for all fulltime, full-year workers in the labor force in the first quarter of 2010. It is assumed that incomes rise 1 percent per year because of overall productivity improvements in the economy and that future incomes are discounted at 3 percent.

[22] As noted, the average within school variation in recent studies is 0.17 s.d. The estimate of 0.2 s.d. is a lower bound for total variation including between school variance. A reasonable upper bound would 0.3 s.d. that is used below. In all cases, it is assumed that only 70 percent of the annual growth in achievement is retained for the future. This calculation comes from standard estimates of depreciation of learning. See Hanushek and Rivkin (2010).

translates into $105,830 for a class size of 20 students. A teacher who is at the 75th percentile produces almost $300,000 in added earnings for her class of twenty, according to prior evidence. A teacher who is at the 90th percentile produces over one-half million dollars in increased lifetime earnings.

The first thing to note is that this is an *annual* increment by the teacher. Any teacher who stays at the given level of performance produces such an amount each year.

The second thing to note from the bottom half of Figure 1 is that a below average teacher (again measured in standard deviations) leads to a similar decrease in lifetime earnings.[23] Thus, having an effective teacher followed by an equally ineffective teacher will cancel out the gains.

All of these estimates are based on rather conservative estimates of the variation in teacher effectiveness (i.e., that 1 standard deviation in teacher effective translates into 0.2 standard deviations in annual student growth). A plausible upper bound on the variations in effectives would be 0.3 standard deviations in annual student growth. At 0.3 s.d., all of the estimated earnings effects above would be 50 percent larger.

On the other hand, the persistence of these estimates is an open question. All of the calculations in Figure 1 presume that 70 percent of a teacher's addition to knowledge carries over permanently (except as modified by subsequent school and family inputs). In reality, maybe all carries over, or maybe only a small part carries over. A host of unknown factors – including compensatory behavior of parents and schools, the cumulative nature of skills, the

[23] The decrease is slightly different because the estimates come from Mincer earnings functions which relate the logarithm of earnings to the level of cognitive skills and thus to a slight different percentage change when evaluated at a different place in the distribution.

specific attributes valued in the labor market, and the nature of peer-classroom interactions come into play in determining the long run impact of specific teachers.[24]

The Demand Side Based on Aggregate Economic Growth

An alternative way of looking at the derived demand for effective teachers comes from the analysis of the impact of student performance on economic growth. Recent analysis has demonstrated a very close tie between cognitive skills of a country's population and the country's rate of economic growth (see the review in Hanushek and Woessmann (2008)). In particular, countries that perform better on international math and science tests have stronger growth of their economies. These analyses suggest that the aggregate impact of increased skills is noticeably larger than the individual impact from the prior calculations.

The magnitude of the effects is truly large. Hanushek and Woessmann (2010) calculate that the present value of increased Gross Domestic Product (GDP) from improving scores by 0.25 standard deviations would be $41 trillion. To get some idea of what 0.25 s.d. on the international tests, it is useful to note that Canada is approximately 0.4 s.d. ahead of the U.S. and that Finland – the current world leader – is approximately 0.58 s.d. ahead.

Now consider what would be possible if we could eliminate the bottom end of the teacher quality distribution and replace these teachers with average teachers. Following the estimates in Hanushek (2009), it is possible to bound the increases in overall performance that could be expected. Using the reasonable estimates (above) of variations in teacher effectiveness as measured by achievement growth—specifically, 0.20 to 0.30 sd.—it is possible to see the impact of the least effective teachers.

[24] The estimate of 0.7 for persistence comes from the typical coefficient on lagged achievement in panel estimates of value-added models. A different analysis by Jacob, Lefgren, and Sims (2008), however, suggests that the persistence of teacher effects may be less, closer to 0.3 by their estimates.

Figure 2 plots the impact on overall student learning of "deselecting" (i.e., moving out of the classroom) varying proportions of ineffective teachers and replacing them with an average teacher. As an example, consider what would happen to average student performance if we could eliminate the least effective 5 percent of teachers from the distribution. The estimates of the impact of teachers on student achievement indicate that these students would on average gain 0.28–0.42 s.d. of performance by the end of their schooling, depending on the bounds of the teacher quality estimates.[25]

These estimates of the importance of teacher quality permit some calculations of what would be required to yield the reforms discussed earlier. To begin with, consider what magnitude of teacher deselection might yield an improvement in student performance to the level of Canada (0.4 sd of student achievement). Figure 2 shows that eliminating the least effective 5-8 percent of teachers would bring student achievement up by 0.4 s.d. If the upper bound on teacher effectiveness is appropriate, replacing the bottom 8 percent of teachers with an average teacher would bring the U.S. up to the level of Finland.

The estimates of the growth impacts of bringing U.S. students up to Finland imply astounding improvements in the well being of U.S. citizens. The present value of future increments to GDP in the U.S. would amount to $102 trillion (Hanushek and Woessmann (2010)). These returns dwarf, for example, all of the discussions of economic stimulus packages related to the 2008 recession ($1 trillion).

Policy makers might ient Spending

It is clear from the prior calculations that improvements in teacher effectiveness would lead to very large economic gains. The estimates of the economic gains are all put in terms of

[25] These estimates apply to a student who starts schooling with the new higher quality teachers and assume that teacher quality is improved in each year of schooling.

present values, but they do not accrue for some years into the future. The estimates of individual earnings gains cover the entire work life of a current student. The estimates of the economic gains to the nation consider gains across the entire lifetime for somebody born today. As a result, many come back to the issue of how we finance any monetary incentives for altering the current teacher workforce. If there are fiscal restraints on governments, say from lowered tax revenues during recessionary periods, it would be important to find financing within the current operating budgets for schools.

As described earlier, the current structure of salaries for teachers pays bonuses for advanced degrees and for added teaching experience. By 2007, over half of all teachers had some sort of advanced degree.[26] As Figure 3 shows, the teachers with advanced degrees have increased as a proportion of the teacher force. As shown in Figure 4, over 85 percent of teachers have more than three years of teaching experience, and receive commensurately higher salaries.

Figure 5 shows the pattern of teacher salaries by degree and years of experience.[27] A teacher with 25 years of experience earns 35 percent more than a teacher with 5 years of experience. The average teacher with a master's degree earns 18 percent more than a teacher with just a bachelor's degree. But, neither higher levels of experience nor advanced degrees are related to teacher effectiveness.

Eliminating or lessening these bonus payments for unproductive background characteristics of teachers could obviously free up substantial amounts of funds. In 2008, 9.5 percent of total teacher salaries went to bonuses for advanced degrees, while 27 percent of total salaries went for experience bonuses for teachers with greater than two years of experience.

[26] Information on teacher degrees and experience is found in U.S. Department of Education (2010), Table 68.
[27] The information on salaries is found in U.S. Department of Education (2010), Table 74.

Policy Conclusions

The key to the prior calculations is that they flow directly from highly effective teachers. It does not flow from increased teacher salaries unless such salaries can be used to attract and retain good teachers effectively.

This paper has concentrated on the demand side of the teacher labor market. The underlying idea is that knowing the impact of teacher quality on economic outcomes provides immediate information about what kind of rational changes in teacher incentives and salaries are possible.

Unfortunately, we know little about the supply function for teacher quality.[28] Thus, it is not possible to predict what kinds of pay changes would be needed to ensure any given quality of teacher force.

The standard performance pay arguments suggest the possibility of differential pay based on effectiveness in the classroom. We actually have little empirical evidence about how to structure any such pay systems or about what the effects might be.[29] The prior evidence here simply suggests that the possible rewards for good performance could feasibly be very large.

There is, however, an alternative to this. If there is an accurate screen on teacher effectiveness, many of the properties of a performance pay scheme can be achieved by eliminating low performing teachers and paying the remaining teachers higher but relatively flat salaries.

[28] There are actually different ways to think about the supply function of teacher quality. One can put the supply of quality into the terms related to salary arguments, where selection of teachers in both hiring and retention decisions is central. On this score, no systematic research exists. Alternatively, one could relate quality to the effort made by existing teachers. This focus is central to the early work on merit pay (e.g., Murnane and Cohen (1986)), but has also been the key element of more recent evaluations such as Lavy (2002, (2009) and Muralidharan and Sundararaman (2009). See also the review of performance incentives in Lavy (2007).

[29] A discussion of current pay schemes can be found in Podgursky and Springer (2007).

The policy of eliminating the least effective teachers is very consistent with the McKinsey evaluation of the policies found in high-performing school systems around the world (Barber and Mourshed 2007). Their evaluation suggests that the best school systems do not allow ineffective teachers to remain in the classroom for long. These conclusions are also consistent with more-local evidence, such as that for New York City, in Kane, Rockoff, and Staiger (2008) and the related policy prescriptions in Gordon, Kane, and Staiger (2006).

Policies of making active decisions on retention and tenure are, of course, uncommon in the current school system. A number of states currently have laws and regulations that lead to tenure decisions as early as two years into a teacher's career, with the mode being just three years (National Association of State Boards of Education 1997, National Council on Teacher Quality 2007). On top of that, the teacher evaluation process as typically seen is very cursory (Toch and Rothman 2008). Nonetheless, these are inconsistent with providing a quality education to all students, because some students must necessarily be relegated to these ineffective, and damaging, teachers.

The idea evaluated in terms of deselection suggests that policies could productively be put in place to identify the most ineffective teachers and to move them out of the classroom. Developing such policies, negotiating them with teachers, and implementing them in the schools clearly take time. It will also require both severance packages for those deselected and higher pay for those who would then have a more risky job.

But there are also other policies that are suggested by the economic aspects of teacher quality. Specifically, the significant differences in the impact of teacher effectiveness are dramatically changed by class size – since all of the impacts on individuals are magnified across entire classrooms. A simple conclusion from the estimates is that, even without eliminating any

teachers, the most effective teachers should be assigned larger classes and the least effective should be assigned smaller classes. In that way, the aggregate impact of less effective teachers is lessened, and the more effective teachers are better utilized. Of course, the more effective teachers might react badly to having larger classes, which in turn require more work. These concerns may, however, be eliminated if teachers are paid a portion of their economic returns.

In the end, there is ambiguity in policy because we have never been able to effectively evaluate what the supply function for teacher quality looks like. This lack of information could, of course, be eliminated by a set of pay experiments. Unfortunately, the current negotiated pay alternatives do not seem to be providing much information – in part because they imply salaries that are relatively insensitive to effectiveness.

The bottom line remains that much higher teacher salaries would be both politically and economically feasible if salaries reflected teacher effectiveness more closely. Without that linkage, we should instead expect teacher salaries to lag those in the general labor market, and we should expect our schools to underperform – to the detriment of the nation.

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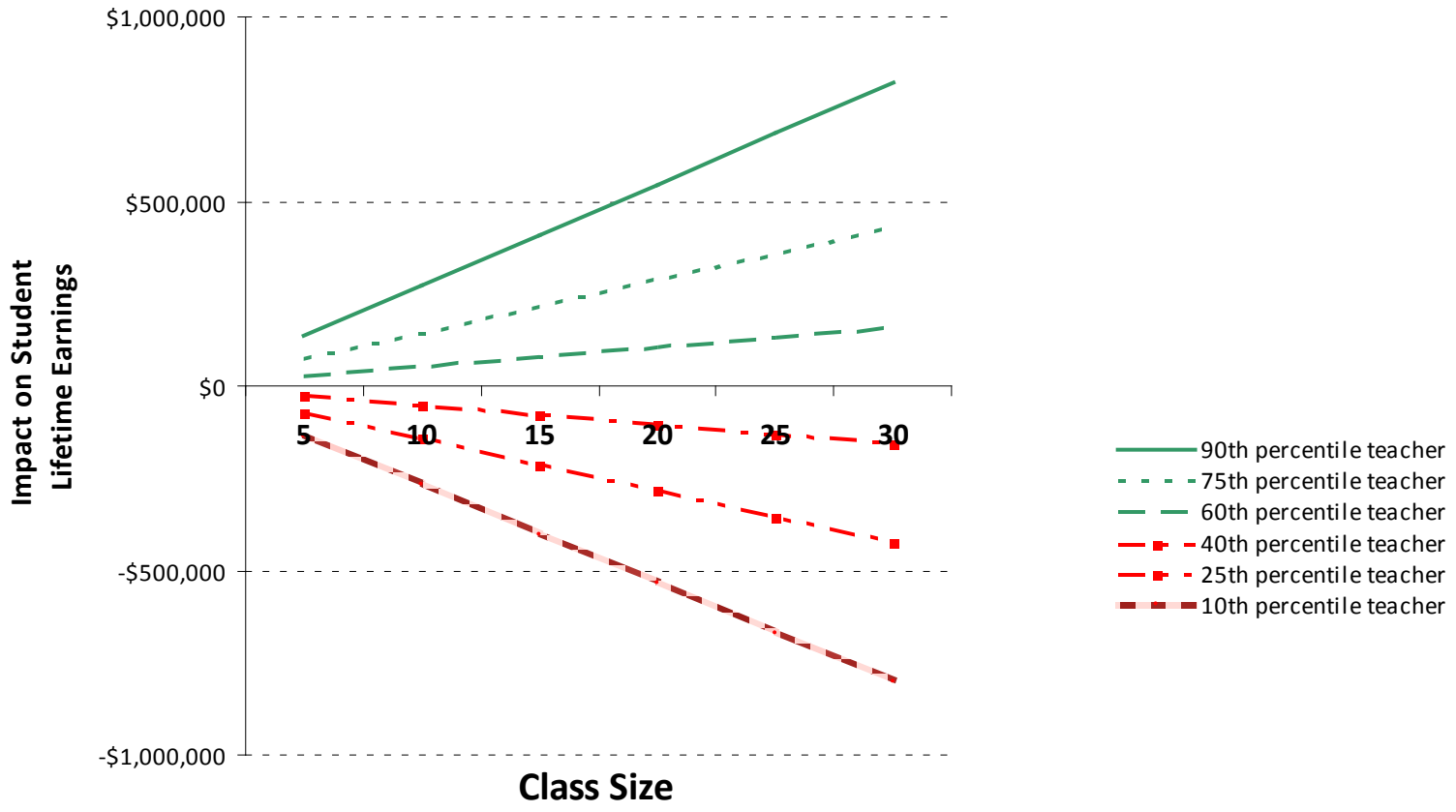
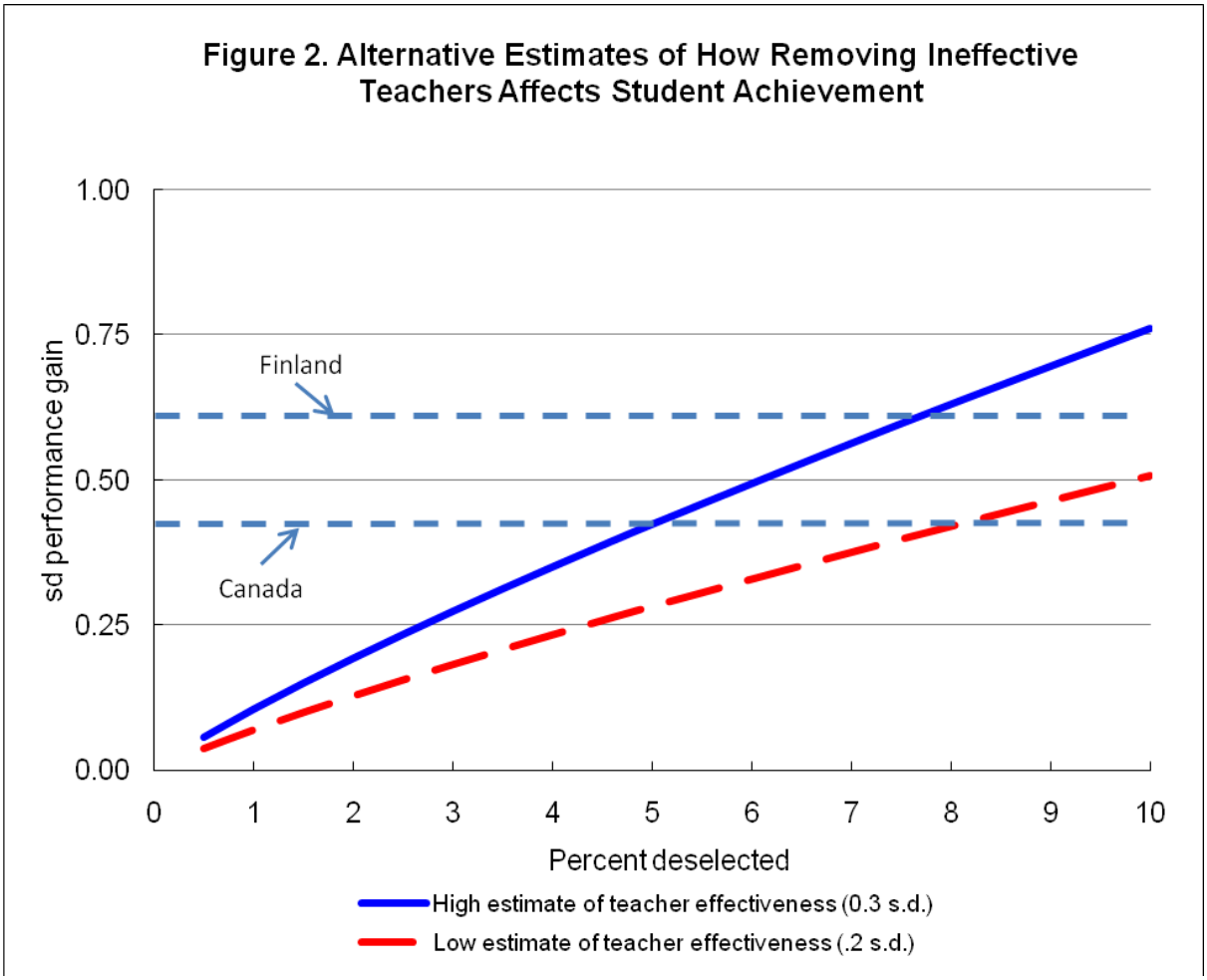
Figure 1. Impact on Student Lifetime Incomes by Class Size and Teacher Effectiveness (compared to average teacher)

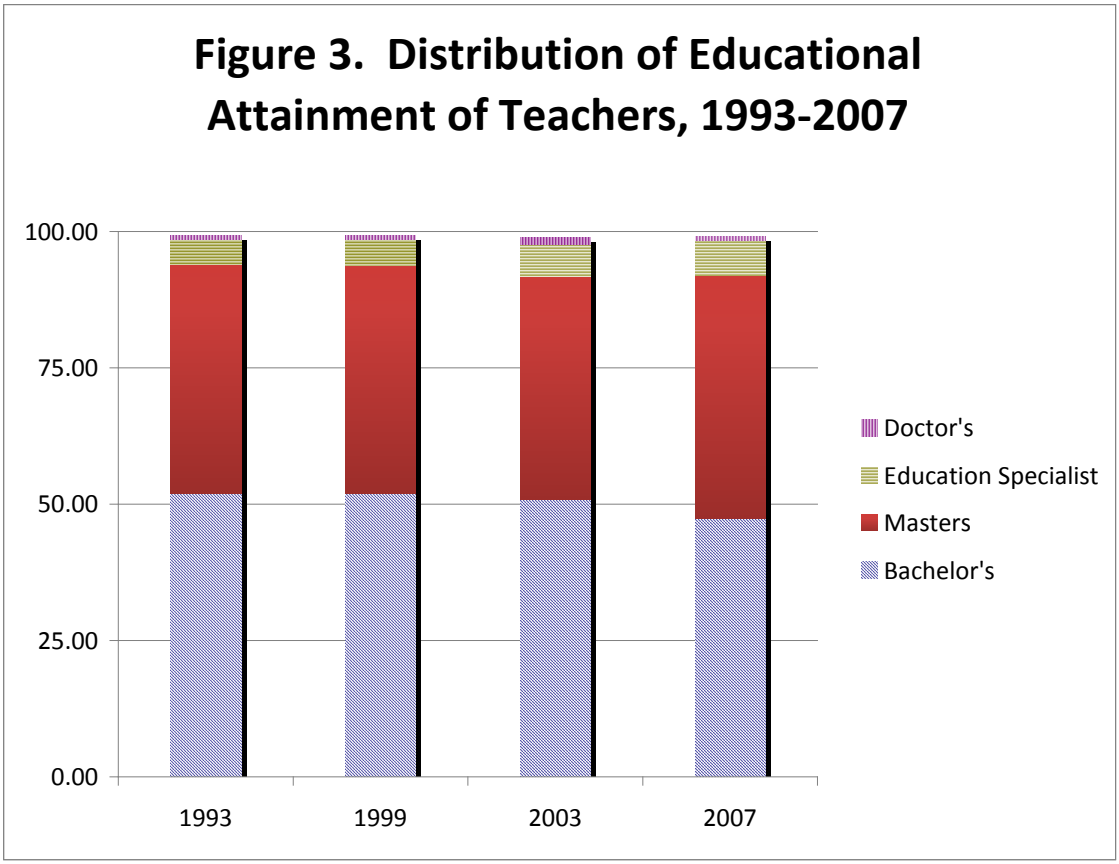


Source: Author calculations.

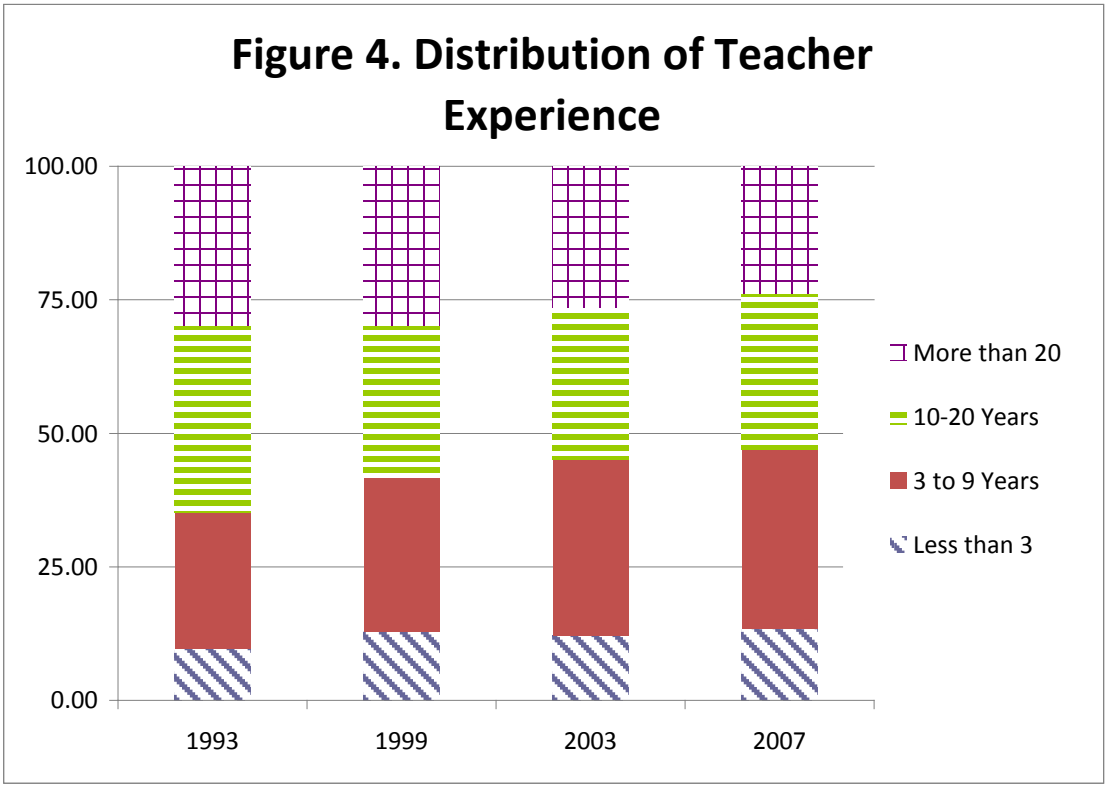


Source: Author Calculations

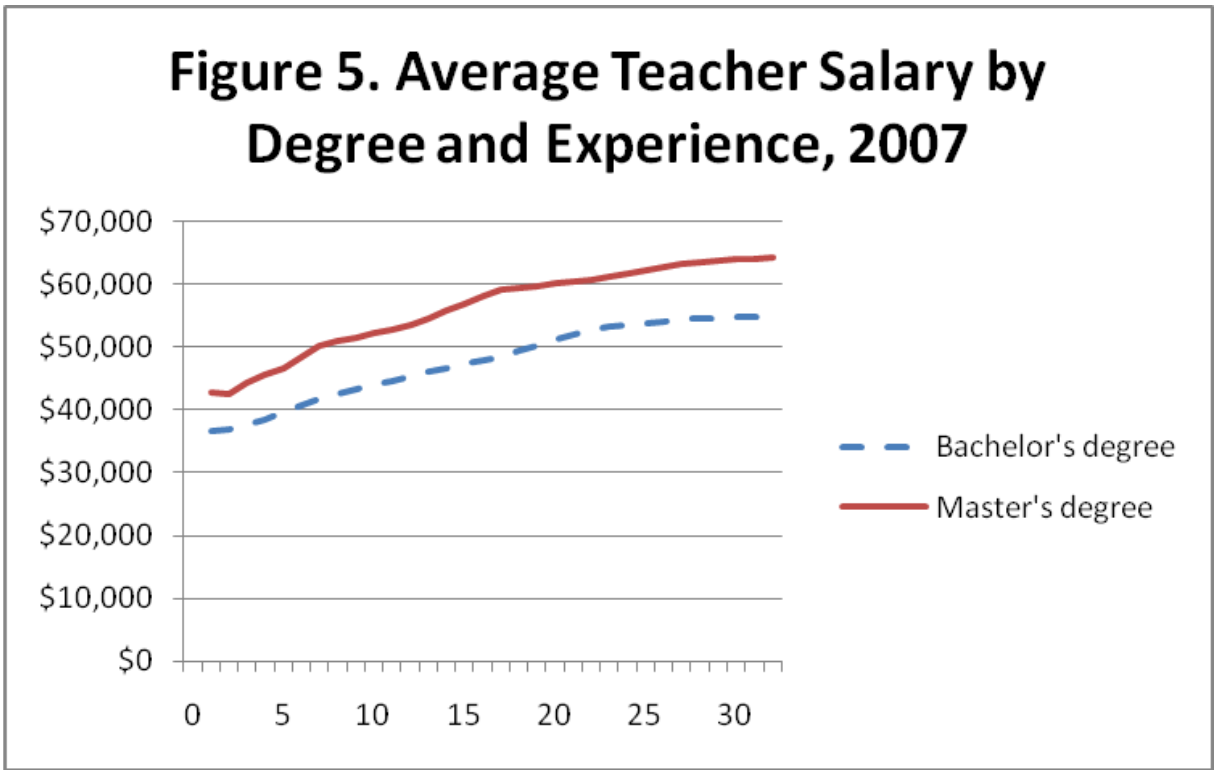
Figure 3. Distribution of Educational Attainment of Teachers, 1993-2007



Source: U.S. Department of Education (2010)



Source: U.S. Department of Education (2010)



Source: U.S. Department of Education (2010), Table 74