Understanding the Twentieth-Century Growth in U.S. School Spending

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ABSTRACT

Persistent increases in spending on elementary and secondary schools have gone virtually undocumented. Real expenditure per student increased 3½ percent per year over the period 1890–1990. Decomposition of the spending growth shows that it resulted from a combination of falling pupil-staff ratios, increasing real wages to teachers, and rising expenditure outside of the classroom. Although the expansion of education for the handicapped has had a disproportionate effect on spending, most of the growth in expenditure during the 1980s came from other sources. Significant teacher salary increases, particularly for females, have failed to keep up with wages in other occupations.

I. Introduction

Vigorous current debate in academe, in government, and in society as a whole surrounds the growth in health care expenditure over the postwar period. Yet, remarkably, the growth in U.S. educational expenditure—which by some standards exceeds that of health expenditure[1]—receives only passing

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1. Using the medical care price index as the deflator, real health expenditure per person in the United States grew at a slower rate than real school expenditure per student between 1970 and 1990. Of course, there are serious questions about what is the proper deflator. For education, that is addressed below. For medical expenditure, see Newhouse (1992).

attention in most policy discussions. Indeed, popular discussions often suggest a perceived lack of commitment to education and concentrate simply on the need to expand resources devoted to education. For example, *A Nation at Risk,* the 1983 report to the U.S. Secretary of Education that is commonly cited as the catalyst for much of the current attention to education, calls for significant increases in resources devoted to education but never considers the history of spending or the spending implications of its recommendations (National Commission on Excellence in Education 1983). Until quite recently, the only serious attention to spending has come through international comparisons, which have been used to argue the case for spending increases.[2] In this debate, school spending as a proportion of gross national product (GNP) is compared, and the United States is found to fall far from the top. These data are offered as a possible explanation for the lagging performance of U.S. students (Hanushek et al. 1994).

This paper, which traces U.S. school spending from 1890 to 1990, demonstrates large and steady increases in spending on U.S. schools. This spending has been propelled not only by the expansion of schooling in the population but also by increases in real per-pupil resources, the costs of which have risen by over 3½ percent per year for the century. This spending growth is subject to varying interpretations, particularly when the expenditures are not embedded with an optimizing framework. Changing expenditure can reflect changes in input costs, an expansion of school responsibilities and objectives (for example special education), altered choices about level of outcomes (or quality), and varying efficiency of resource use. Although this analysis does not directly consider outcomes or efficiency, it does present the patterns of expenditure changes over time in a way that permits linkage with the literature on student outcomes.[3]

The century-long expansion of elementary and secondary school spending may, however, now be threatened, as student enrollment grows and policymakers and the public increasingly consider resource constraints. A preliminary step to establishing rational spending policies is understanding the underlying causes of prior growth in spending. To do this, we extract information from a variety of sources and construct a consistent data series tracing the evolution of U.S. public schools between 1890 and 1990. These data are employed to decompose the observed growth into a series of more fundamental changes in costs and operations. The expenditure analysis begins with a decomposition of educational spending into four groups of factors: (1) student enrollment; (2) instructional staff per pupil and the school year length; (3) the price of instructional staff; and (4) other spending.[4]

2. The original publication of the Economic Policy Institute (Rasell and Mishel 1990) led to considerable debate and reanalysis; see, for example, Nelson (1991) and Ram (1995). The international data have received additional stature through publication in widely circulated reports such as Education at a Glance, published by the Organization for Economic Cooperation and Development (1993).

3. Analyses of school resources effects on student outcomes require information on student outcomes, school resources, and other determinants of achievement. Although hotly debated elsewhere, such efficiency questions are not considered in this paper. For a range of analyses of this subject, see Hanushek (1986, 1989, 1994, 1996), Hedges Laine, and Greenwald (1994), Card and Krueger (1992, 1996), Hanushek et al. (1994), and Hanushek, Rivkin, and Taylor (1996).

4. An additional factor, not directly addressed here, is that school costs have been pushed up by students who are more expensive to educate, say, through increases in single-parent households or child poverty.

Subsequently we examine the growth in special education, the rise in teacher salaries, and the increase in noninstructional spending in greater detail.

II. Conceptual and Analytical Background

This analysis has several purposes, including documentation of resource trends in schools, analysis of the driving forces behind these trends, and development of a foundation for judging performance changes in schools. These purposes do not, however, lead to the same analytical approach or interpretation.

A natural starting point for evaluating spending changes would be to consider resource and input price changes within the context of a production function for schools. This approach would permit disentangling the importance of quality improvements, input price changes, and policy choices. But, as is well-known, we lack any consistent and accepted description of the production process (Hanushek 1986). An alternative starting point, pursued here, simply focuses on the changing expenditure pattern and attempts to decompose it into cost increases and real resource changes.

The consideration of expenditure in education or other labor-intensive activities typically refers to the cost implications of differential technological change and productivity growth, a discussion that implicitly assumes efficient choices. The well-known theory, originally suggested by Scitovsky and Scitovsky (1959) and subsequently developed by Baumol and Bowen (1965) and Baumol (1967), concentrates on the cost disadvantages of a sector, of which education appears to be a prime example, that experiences little technological change while other sectors undergo regular productivity improvements. Because wages rise roughly in proportion with the average growth rate of labor productivity in all sectors, the technologically stagnant sector faces increased labor costs. It is often assumed that the nature of its production technology prevents the stagnant sector from substituting away from the increasingly costly labor inputs, thus leading to increasing unit costs of output.[5] Depending upon demand elasticities for output, such cost increases can lead to either declines in the relative size of the nonprogressive sector or disproportionate increases in the resources devoted to that sector. These simple predictions, often termed simply "Baumol's disease," dominate explanations for cost growth in government services, the arts, many nonprofit activities, and other industries where labor services are the most significant input factor.

Direct investigation of this, though difficult to do precisely without an accurate description of the underlying cost function, does not suggest major recent changes because some improvements also offset these factors, such as the increases in parental education or reductions in family size. The analysis by Grissmer et al. (1994) suggests net positive changes for Whites but net negative changes for Blacks. That analysis employs cross-sectional regressions of test scores on family background to obtain weights on trends in family characteristics. Such an analysis, however, neglects the potential impact of differential school effectiveness and assumes that any deviation of trend from the predicted value is due to schools.

5. The lack of substitutability can arise from either fixed-coefficient production (for example, the need for four musicians is a horn quartet) or because the quantity of labor input is directly related to perceived quality (for example, class sizes and the demand for teachers in schools).

The rising per-unit costs of low productivity growth rate sectors imply that real increases in society's resources are needed in order to maintain a given quality of service provision. Therefore the observed increase in real per student expenditure, where school expenditures are deflated by an economy wide output deflator, such as the GNP deflator, overstates the actual increase in educational resources purchased per student.[6] In order to isolate the changes in the quantity of educational resources purchased, one must fully account for the real increases in schooling input costs.

Some researchers construct an education cost deflator, which places substantial weight on the wages of a benchmark category of labor, in order to estimate the time series pattern of changes in real schooling inputs. We do not adopt this strategy for the following two reasons. First, wage deflators are notoriously difficult to adjust for quality differences, a key concern in the consideration of teachers. This difficulty is especially acute when considering specialized labor inputs, such as highly educated workers, where secular changes in both the supply of and the demand for skills are relevant. Second, an extremely important factor has been the change in the overall labor market for women, the dominant component of the teaching force. Particularly over the post–World War II period, teaching has moved from one of the most attractive occupations for women to a much lower position in terms of pecuniary rewards and, perhaps, status. This movement, which includes the lessening or elimination of a variety of barriers to women in the general labor market, implies dramatic shifts in the market for teachers that would be captured only imperfectly through standard wage indices or deflators for service industries.

Our approach to identifying the impact of low productivity growth begins with a description of growth in educational expenditure adjusted for price changes with the GNP deflator. This approach indicates changes in societal resources devoted to schooling. Next we decompose growth in total spending into a number of factors, including changs in the price of teachers. Finally, we compare the time series of earnings for men and women teachers with earnings changes for all nonteachers, and for the subset of nonteaching college graduates. Recent increases in wage inequality indicate that a general wage index will understate the cost pressure faced by schools. By directly analyzing how teacher wages have changed relative to other categories of workers in the economy, we provide an explicit analysis of the importance and effect of "Baumol forces" on the cost of the primary input of schools.

The special nature of the educator sector, where educated workers are an intermediate good in producing education, does introduce an unusual twist in decision making about educational investments and evaluation of the Baumol

6. Rothstein and Miles (1995) consider an alternative deflator in their analysis of cost changes in a sample of nine school districts. Their preferred approach, building on general Baumol-Scitovsky arguments, is to use an adjusted consumer price index for the service industries. This use of an alternative output deflator can indicate how education cost changes compare to a low productivity sector in the economy, but it clearly does not provide a good input deflator unless a number of other dubious assumptions are met.

hypothesis. Because the value of education, an intermediate good in the production process, rises in proportion to wages paid to educated labor, changes in the price of educated labor do not affect the rate of return to human capital investment. Thus, on a cost-benefit criterion, the rising cost of college-educated labor will not affect the investment decision rule, even though the amount of resources devoted to schooling rises along with the price of educated labor.

III. History of Spending Growth: 1890–1990

Between 1890 and 1990 real public expenditure on primary and secondary education in the United States rose from $2 billion to over $187 billion.[7] Importantly, this almost 100-fold increase was more than triple the growth rate of Gross National Product during this period: current educational expenditure increased from less than 1 percent of GNP in 1890 to 3.4 percent of GNP in 1990. (Spending as a percent of GNP actually peaked around 1975 at 3.9 percent. As described below, this percentage was affected noticeably by the demographics of the school age population, making it a poor statistic for comparing the intensity of resources devoted to schooling).

Although increasing enrollment accounted for a portion of the rise in spending, rising per-student expenditure explained the bulk of the change in educational outlays. Figure 1 plots the increase in per student expenditure that occurs between 1890 and 1990. Real per student expenditure was $164 in 1890, $772 in 1940, and $4,622 in 1990—roughly quintupling in each 50-year period. Figure 1 also divides per student expenditure into salaries for instructional staff (teachers, principals, and other instructional personnel) and all other expenditure. The unmistakable pattern here is the relative growth of expenditure outside of instructional staff salaries, going from one-fifth of total current expenditure in 1890 to one-third in 1940 and to more than one-half in 1990 (see Table 1). (As discussed below, the "Other Expenditures" spending category includes items directly related to instructional activity and to teacher compensation, but a finer division than used here is not possible because of data limitations.) Spending on instructional staff salaries is subsequently referred to simply as "instructional staff spending," even though it does not include staff benefits.

The expenditure analysis begins with a decomposition of changes in instructional staff spending and subsequntly turns to the remaining expenditure components. The salary budget receives primary consideration because it is determined by key policy and choice variables and this expenditure seems most closely and obviously related to the classroom. Our instructional staff includes teachers, principals, assistant principals, guidance counselors, psychologists, and librarians

7. All monetary measures are adjusted by the GNP deflator to constant 1990 dollars. Throughout this paper we concentrate on current expenditure, namely, total expenditure less capital investment. Unless otherwise noted, we also use public school expenditure, excluding that going to private schools. For the most part, the qualitative results that we present are unaffected by concentrating on this narrower defnition of spending.

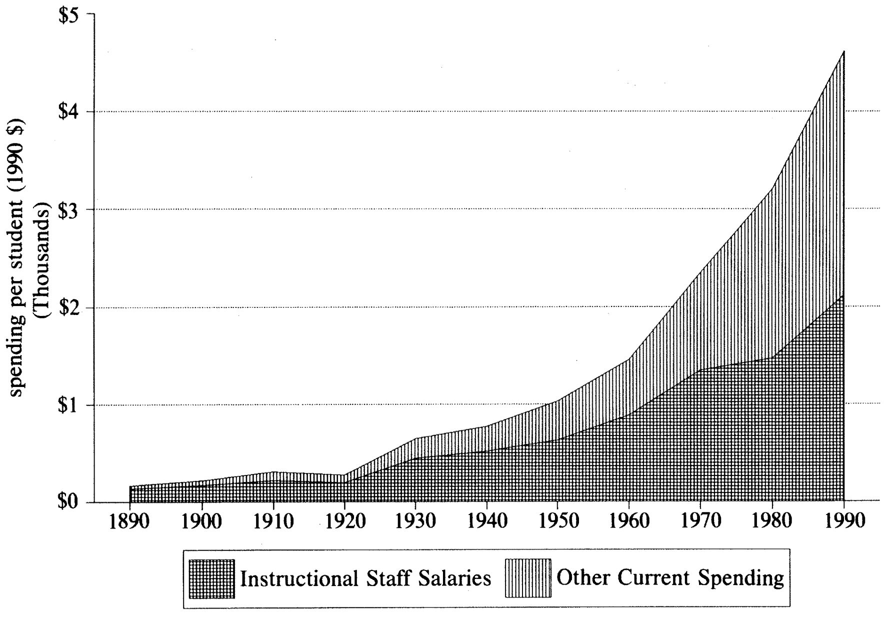

Figure 1
Real Current Spending per Pupil, 1890–1990

but excludes aides. The various government statistics have used inconsistent definitions of instructional staff over time; we, however, attempt to maintain a constant definition throughout our analysis.[8] The appendix provides a detailed description of the data series used in this study.

The bottom portion of Table 1 documents changes in major variables that affect instructional staff spending. These are loosely grouped into three categories: quantity, intensity, and input cost. "Quantity" captures expenditure changes related to student enrollment, which in turn reflect increases or decreases in either the school-age population, the school enrollment rate, or the division of students among public and private schools. "Intensity" refers to factors that conceptually affect the content or quality of a year of schooling. These include the length of the school year and the pupil-instructional staff ratio. Finally, "input cost" refers to changes in the price of instructional personnel.[9]

8. Data from the National Center for Education Statistics include aides in the calculation of average salaries of instructional staff in 1990 but not earlier years. This change biases downward the salaries and thus salary growth for calculations involving 1990, but the small weight on aides implies that the effect will not be large.

9. Teacher quality is an additional variable that affects school quality. Though no measure of teacher quality is included in the decomposition, we provide some information on the changes in teacher quality by using U.S. Census data to analyze the changing earnings distribution for teachers relative to other college-educated workers in Section V.

Table 1
Values of Real Current Education Expenditure and Key Explanatory Variables: 1890–1990

	1890	1940	1950	1960	1970	1980	1990
Total current expenditure (billions 1990$)	2.1	19.6	25.8	52.5	107.1	133.5	187.4
Instructional staff expenditure (billions 1990$)	1.7	13.2	15.8	31.9	61.5	61.9	86.0
Other expenditure (billions 1990$)	0.4	6.4	10.0	20.5	45.6	71.5	101.4
Quantity							
Population aged 5–19 (millions)	21.2	34.8	34.9	48.7	59.8	56.1	53.0
Enrollment rate (percent)[a]	68.4	80.7	81.6	85.8	85.8	83.4	86.7
Public school enrollment rate (percent)	87.9	90.7	88.1	86.4	88.9	89.1	88.3
Intensity							
Pupil-instructional staff ratio	35.0	28.1	26.3	24.9	20.5	17.3	15.4
Days per year	135.0	175.0	178.0	178.0	179.0	179.0	179.0
Input Cost							
Daily wage of instructional staff (1990$)	34.2	83.3	93.1	123.7	154.7	143.4	182.8

Notes: The data sources are described in the appendix.
a. The enrollment rate refers to the enrollment rate in elementary and secondary school among the population aged 5–19.

The specific decomposition of spending concentrates on the central elements of school policy and of the overall change in schooling during the century, but other factors surely have contributed to spending changes.[10] For example, the relative increase in the proportion of students in secondary schooling as compared to primary schooling has contributed to some of the underlying trend, through reducing class sizes and requiring more expensive teachers.[11] Similarly, unioniza-

10. An alternative approach to the decomposition of school spending traces out changes in standard financial accounts (such as general fund, special education, maintenance, and the like). This approach, dictated more by data availability than by conceptual desirability, has been pursued by Lankford and Wyckoff (1993, 1996) and Rothstein and Miles (1995).

11. The changing mix between elementary and secondary schools is only important in the pre-World War II period. The proportion of students in elementary school (K–8) is: 1890–98.4 percent; 1940–74.0 percent; 1970–71.5 percent; 1990–71.9 percent.

tion has undoubtedly contributed to pressures to reduce class sizes and to increase salaries along with changing the general political economy of spending decisions. For many purposes it is appropriate to view this analysis as a reduced-form approach, where the underlying causal factors leading to the changes in intensity and costs are not explicitly appraised.

We define the following identity as a basis for the decomposition:

$$\text{(1)}\quad \text{Instructional Staff Spending} = POP * ENRATE * PUBLIC/PSRATIO *DAYS * TPRICE,$$

where *POP* = population aged 5–19; *ENRATE* = enrollment rate (number of elementary and secondary students divided by *POP*;[12] *PUBLIC* = proportion public school enrollment; *PSRATIO* = pupil-instructional staff ratio;[13] *DAYS* = school days per year; and *TPRICE* = average daily wage of teachers and staff. The decomposition of spending growth begins by taking the logarithm of both sides of Equation (1) and then calculating differences between time τ and τ'.

$$\text{(2)}\quad \underset{\tau\to\tau'}{\Delta}\,\text{Ln(Instructional Salary Expenditure)} = \Delta\,\text{Ln}(POP) + \Delta\,\text{Ln}(ENRATE) + \Delta\,\text{Ln}(PUBLIC) - \Delta\,\text{Ln}(PSRATIO) + \Delta\,\text{Ln}(DAYS) + \Delta\,\text{Ln}(TPRICE).$$

This growth accounting framework implies that factors changing proportionately more will account for a greater percentage of expenditure growth. Equation (2) (divided by the length of the time period) provides direct estimates of the annual growth in real spending attributable to each factor. We also normalize these by comparing each to the change of (log of) instructional staff spending, thus giving the relative importance of the various factors. Although the specific deflator used to calculate real spending affects the estimated importance of salary increases, the growth rate of the other factors is unaffected.[14]

12. The denominator includes many 18- and 19-year-olds who began first grade more than 12 years earlier. These students are likely to be out of secondary school (and maybe already in college), leading to a downward bias in the relevant enrollment rate. Nevertheless, because only changes in enrollment rates affect the cost decomposition, the systematic downward bias in the enrollment rates for all years will lead to little misestimation of the growth in enrollment rates and in costs.

13. Because of inconsistent data over time on salaries and staff counts, we concentrate on the pupil-instructional staff ratio instead of the pupil-teacher ratio. Teachers make up the bulk of instructional staff, defined by us as a consistent series including teachers, principals, assistant principals, guidance counselors, psychologists, and librarians, but not teacher's aides. At least for the past 30 years, teachers have been an almost constant 90 percent. The data on instructional staff published by the National Center for Education Statistics have used inconsistent definitions over time, so our calculations do not match the various published data from NCES.

14. Inflationary growth in salary expenditure is simply a constant on both sides of Equation (2). The estimated growth in both total real expenditures and real salaries will vary by the deflator, thus altering the apparent importance of salary growth and the relative impact of each factor.

Table 2
Changes in Annual Growth of Instructional Salary Expenditure Attributed to Input Changes by Periods: 1890–1990 (Percentages of total in parentheses)

	Period				
	1890–1940	1940–70	1970–90	1980–90	1890–90
Quantity					
School age population	1.0	1.8	−0.6	−0.6	0.9
	(24.0)	(35.3)	(−36.0)	(−17.6)	(23.3)
Enrollment rate	0.3	0.2	0.1	0.4	0.2
	(8.0)	(4.0)	(3.1)	(11.8)	(6.0)
Public school enrollment rate	0.1	−0.1	−0.0	−0.1	0.0
	(1.6)	(−1.3)	(−2.0)	(−2.5)	(0.1)
Intensity					
Pupil-instructional staff ratio	0.4	1.0	1.4	1.1	0.8
	(10.6)	(20.5)	(85.2)	(34.1)	(20.8)
Days per year	0.5	0.1	0.0	0.0	0.3
	(12.6)	(1.5)	(0.2)	(0.0)	(7.2)
Input cost					
Price of teachers	1.8	2.1	0.8	2.4	1.7
	(43.2)	(40.3)	(49.7)	(74.1)	(42.6)
Total annual growth	4.1	5.1	1.7	3.3	3.9
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

The proportions of change explained by each of the six variables for different time periods are presented in Table 2. We divide the century considered (1890–1990) into three subperiods: 1890–1940, 1940–70, and 1970–90. This divides the postwar period between years of rapid growth in student enrollment and years in which enrollment declined. Finally, in order to capture the most recent changes, we isolate the decade of the 1980s.[15] These periods tell a striking story of educational change.

A. "The Great Expansion": 1890–1940

The rapidly rising school-age population and the increasing public school enrollment rate accounted for roughly one-third of the $11.5 billion increase in real instructional salary expenditure between 1890 and 1940. The school-age population grew by 13.6 million, the enrollment rate rose from 68.4 percent to 80.7

15. Note from Table 1 that total instructional staff salary expenditure is virtually constant during the 1970s, and, therefore, the decomposition is not useful. This constancy resulted from decreases in the school age population and the salaries of teachers that almost exactly offset increases in the intensity of instruction (namely, decreases in the average pupil-teacher ratio).

percent, and the percentage of students attending public school increased by 3 percentage points, yielding an overall increase of 12.7 million public elementary and secondary school students during this period.

Even during this period of rapid expansion, however, per-student increases accounted for two-thirds of the rise in instructional salary expenditure. The real price of teachers increased by a factor of 2.5, by itself accounting for a 1.8 percent annual growth in real expenditure and explaining 43 percent of expenditure growth. Changes in the length of the school year and the pupil-staff ratio (the two elements of intensity) accounted for over one-fifth of the expenditure increase. The average school year lengthened by 40 days. The pupil-staff ratio declined from 35 students per instructional staff in 1890 to 28 students in 1940, a decrease of roughly 20 percent in 50 years. Some of the changes in both pupil-staff ratios and teacher salaries over this period may have reflected the movement toward secondary schooling. The proportion of public school students in elementary school (K–8) fell from 98 percent in 1890 to 74 percent in 1940.[16] (This decline was essentially complete by 1940). This was also a period of improving public schools for blacks, but again these changes cannot explain a large portion of the overall spending changes even if they did have some effect on aggregate spending.

B. "The Baby-Boom": 1940–70

The immediate postwar period, though differing in details, was marked by a very similar pattern of expenditure increases to that in the prewar period. Increases in simple numbers of students attending public schools between 1940 and 1970 accounted for somewhat more of the expenditure increase compared to the earlier period in both absolute and relative terms. Public school enrollment increased by over 20 million students, accounting by itself for 38 percent of the real expenditure increase (or 1.9 percent annual spending growth). The overall school enrollment rate rose by 5 percentage points during this period, though the proportion of students attending public school fell by 2 percentage points. But, the role of these latter changes, which were more important before 1940, pales in comparison to the rapid growth of the school-age population during the baby boom.

The rising price of instructional staff again accounted for 40 percent of the expenditure increase. It nearly doubled in real terms, increasing from \$83 per day in 1940 to \$155 per day in 1970. As in the prewar period, this price increase had the largest impact on expenditure of any of the input changes, leading to a more than a 2 percent annual growth in total spending.

The two intensity components accounted for the remaining 20 percent of the expenditure increase, but almost all was explained by the declining pupil-staff ratio, because the length of the school year increased only slightly. The pupil-staff

16. Although the relative increase in secondary school students would have some effect on costs, the changes could not be responsible for the observed movement in spending per student or in pupil-staff ratios. For example, if the relative movement were to explain the growth in spending from \$164/student to \$772/student, the cost of secondary students would have to be 23 times that for elementary students. Similarly, the pupil-staff ratio in elementary schools would have to be five times that in secondary schools. To explain half of the spending growth, the cost of secondary schools would still have to be ten times that for elementary schools on a per-pupil basis.

ratio decreased from 28.1 to 20.5 during this 30-year period, a drop exceeding both in absolute and percentage terms the decrease in the previous 50 years. This decline reflected primarily increases in teachers, not in other staff.

C. "The Great Intensification": 1970–90

The character of cost growth in the 1970s and 1980s changed dramatically from the earlier periods of the century. Public school enrollment fell significantly through 1985, and though it rebounded some in the late 1980s, enrollment was five million students lower in 1990 than in 1970, due almost entirely to a decline in the school-age population. Nevertheless, total expenditure continued to grow, reflecting the rapid pace of per-student expenditure growth.

Since 1970, instructional staff price changes have accounted for a substantial portion of the increase in per-student expenditure, though as Table 1 indicates, all of the increase occurred after 1980. Between 1970 and 1980 the real price of instructional staff actually declined by an average of over $10 per day, failing to keep up with the high inflation rates. But between 1980 and 1990 the price of staff jumped by almost $40 per day, imposing tremendous cost pressures on schools. Over the 1970–90 period, aggregate spending increases attributed to real instructional staff price increases exceeded the aggregate cost savings from the reduced quantity of school children. (But, as detailed below, the rapid rise in salaries for college graduates during this period was an important component of this growth, suggesting that this component may be more related to "Baumol forces" and to the aging of teachers than to increases in the quality of the teacher pool.)

The largest factor in expenditure growth, however, was the decline in the pupil-staff ratio. It fell from 20.5 in 1970 to 15.4 in 1990. This factor by itself accounted for 85 percent of the aggregate instructional staff expenditure of almost 25 billion dollars between 1970 and 1990. Although the rate of decline/increase slowed in the 1980s (see Table 1), its impact on expenditure remained strong.

Two factors stand out as being of primary importance throughout the entire 100-year period: the rising price of instructional staff and the declining pupil-staff ratio. Rising salaries were clearly a consequence of economy-wide labor productivity growth, (the extent to which instructional staff salaries changed relative to those of other workers is an important issue that we examine in Section V). On the other hand, the decisions leading to the reductions in the pupil-staff ratio despite the rise in instructional staff costs suggest a long-term policy of attempting to raise school quality by reducing the pupil-staff ratio.[17] There is substantial debate over the extent to which external changes, notably the expansion of special education, contributed to the decline in the pupil-teacher and pupil-staff ratios during the 1970s and 1980s.[18] We consider the contribution of special education to the decline in the pupil-staff ratio in Section IV.

17. An alternative explanation is that schools attempted to protect employment during periods of falling enrollment. Although this may have been the initial motivation, subsequent data indicate that the reductions have been permanent, resistant to any increase in rising enrollment. The efficacy of improving school quality through reducing pupil-teacher ratios has at the same time been seriously questioned; see below.

18. Much of the consideration of special education expenditure is motivated by questions about the level of resources allocated to regular classes. Surprisingly, there is virtually no discussion of the outcome or value of the special education expenditure per se.

The decomposition of spending changes may partially explain why public perceptions about school expenditure diverse so significantly from reality. During the last two decades, the drop in the school-age population effectively masked much of the spending change. Between 1970 and 1990, the decrease in the number of students offset most of the rise in the price of teachers. Therefore, in terms of aggregate spending—and the tax rates required to cover school expenditure—the changes required were less than the increase in real spending per student. This offset was even more dramatical through the first half of the 1980s, when the total school population fell each year.

Figure 2, which shows the annual growth rates for total spending and for per-pupil spending during the post–World War II period, captures these changes. Except for the high growth during the 1960s, the average growth in real per-pupil spending has been relatively constant, ranging between approximately 3 and 3.5 percent percent per year over this half century. Although fluctuating more during the first half of the century, the annual growth rates for real spending per pupil averaged 3.1 percent between 1890 and 1940. Thus, for the century as a whole, growth rates in school expenditure per pupil have been approximately double those for real GDP per capita.[19] But the pattern for total spending, which has been affected directly by changes in the growth rate of the student population, has been much more erratic, ranging between 2 and 7½ percent per year during the postwar period (and between 1 and 11 percent in the earlier half century). Most important, the recent two decades have seen growth in total spending fall below growth in spending per pupil, as the student population fell while per-pupil spending continued its growth. If school budgets are described in terms of growth of total spending, the decades of the 1970s and 1980s showed noticeably more moderate growth than the decades of the 1950s and 1960s.

This fortuitous situation is changing. During the late 1980s, the offset of falling enrollment ended as the school-age population began growing again (National Center for Education Statistics 1995). Data on school enrollments since 1990 suggest a continued turnabout that will add to aggregate expenditure instead of subtracting from them. If the hypothesis that changes in the aggregate population supported a lack of concern about overall expenditure increases is true, schools may find themselves facing a much more difficult fiscal situation in the future.

IV. The Declining Pupil-Teacher Ratio and the Expansion of Special Education

The cost movements that are observed in Table 1 suggest that the changes did not reflect adjustments in relative prices: the pupil-instructional staff ratio declined steadily, regardless of whether the price of instructional personnel increased or decreased. This steady fall in the pupil-teacher ratio with the commensurate increase in real educational costs is particularly noteworthy in light of

19. Annual growth rates of GDP/person are 1.2 percent from 1913–50; 2.2 percent form 1950–73; and 1.6 percent from 1973–89 (Maddison 1991, p. 49).

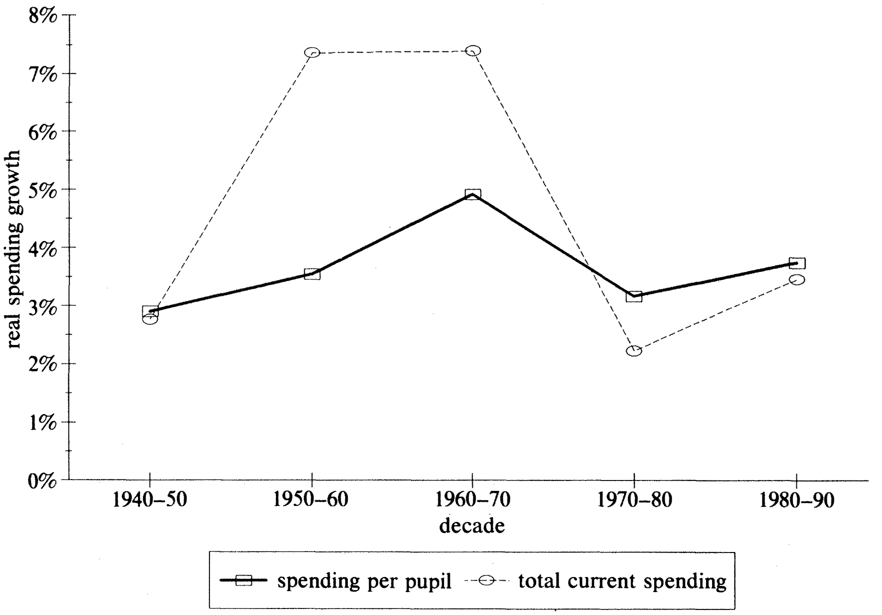

Figure 2
Annual Growth in Total and per Student Real Spending, 1940–90

the substantial questions that have been raised about whether variations in the pupil-teacher ratio and in class size[20] affect student performance.[21] If unrelated to student performance, this portion of expenditure would represent a pure cost increase that lowers the return to any educational investment through inefficiencies.

An opposing view asserts that much if not all of the recent fall in the pupil-instructional staff ratio is attributable to changes in the school population. The growth in students with identified handicaps coupled with legal requirements for providing educational services for them has increased the size of the special education sector. Therefore, the expansion of the more staff-intensive special education sector could reduce the overall pupil-staff and pupil-teacher ratios with-

20. Although the pupil-teacher ratio and class size are highly correlated, they are clearly distinct measures of school resource use. The pupil-teacher ratio is determined by class size and the ratio of average classes taught by teachers divided by the average classes attended by students.

21. Early experimental evidence is summarized in Glass and Smith (1979). Econometric evidence from estimation of educational production functions is found in Hanushek (1986, 1989) and Hanushek, Rivkin, and Taylor (1996). More recent experimental evidence from the State of Tennessee is presented in Word et al. (1990) and is summarized by Mosteller (1995). Some controversy does remain. Some studies find smaller classes to be important (for example, Ferguson (1991), and Akerhielm (1995), but these are balanced by an almost equal number of studies finding the opposite. The experimental studies are also subject to varying interpretation; see Hanushek et al. (1994).

out commensurate decreases in mainstream class sizes. To the extent that mandated expenditure for handicapped students are driving the fall in the pupil-staff and pupil-teacher ratios, regular class sizes are not declining and, by extension, one might not expect any improvement in measured student performance.[22] This section provides a simple analysis of the potential importance of special education in explaining the pupil-teacher ratio fall and commensurate increase in educational expenditure.

Concerns about the education of children with both physical and mental disabilities were translated into federal law with the enactment of the Education for All Handicapped Children Act in 1975.[23] This act prescribed a series of diagnostics, counseling activities, and services to be provided for handicapped students. To implement this and subsequent laws and regulations, school systems expanded staff and programs, developing entirely new administrative structures in many cases. The general thrust of the educational services has been to provide regular classroom instruction where possible ("mainstreaming") along with specialized instruction to deal with specific needs. The existence of partial categorical funding from outside and of intensive instruction for individual students creates incentives for school systems to expand the population of identified special education students and incentives for parents to seek admission of their children into special education programs (see Hartman 1980, Monk 1990). The result has been a growth in the number of students classified as special education students even as the total student population has fallen.

The aggregate changes between 1978 and 1990 in the population identified as disabled are shown in Table 3.[24] Despite the fact that overall public school enrollment declined by more than 1.5 million students between 1980 and 1990, the number of students classified as disabled increased from 4.0 million in 1980 to 4.7 million in 1990. Therefore the percentage of students classified as disabled increased from 9.7 to 11.6 percent during the period. Moreover, the number of special education teachers increased much more rapidly than the number of children classified as disabled. Table 3 shows that the number of special education teachers and other instructional staff increased by more than 50 percent between 1978 and 1990,[25] the number of special education teachers rose from 194,802 to 307,575, while the number of other special education instructional personnel rose

22. Although little evidence is available, it is frequently asserted that special education students are not generally included in tests and other measures of performance. Therefore, in assessing performance, it would be appropriate to link expenditure on regular-instruction students with their test performance. On the performance side, however, if a larger proportion of students are identified as special education and if these are generally students who would perform poorly on tests, the shift to increased special education over time should lead to general increases in test scores ceteris paribus.

23. This act, P.L. 94–142, is commonly identified as having direct and significant effects on the cost and methods of delivery of local education. See discussion and evaluation in Hartman (1980), Singer and Butler (1987), and Monk (1990).

24. Data on special education come from annual reports required as part of the Individuals with Disabilities Education Act of 1976. On years prior to this act, no consistent data on handicapped students or their schooling are available.

25. Precise accounting for special education personnel is frequently difficult, suggesting that these data contain more error than the other aggregate data presented.

Table 3
Special Education Population and School Personnel: 1978–90

Year	Disabled Children (aged 0–21 years) [1,000s]	Percentage of Elementary-Secondary Students	Special Education Personnel (1,000s)		
			Teachers	Other Instructional	Noninstructional Personnel
1978	3,777	8.7	195	140	32
1979	3,919	9.2	203	178	37
1980	4,036	9.7	221	159	56
1981	4,178	10.2	233	167	40
1982	4,233	10.6	235	168	46
1983	4,298	10.9	241	168	57
1984	4,341	11.1	248	173	53
1985	4,363	11.1	275	172	54
1986	4,370	11.1	292	183	47
1987	4,422	11.1	296	175	48
1988	4,494	11.2	301	192	49
1989	4,587	11.4	303	208	48
1990	4,688	11.6	308	220	53

Source: For student numbers, U.S. Department of Education, *To Assure the Free Appropriate Public Education of All Children with Disabilities,* Thirteenth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 1991, p. 4; for teachers and other personnel and various individual annual reports, see the data appendix.

from 140,183 to 219,752.[26] The number of noninstructional special education staff, though it rose before 1980, remained roughly constant during the 1980s.

These numbers suggest that the previously noted decline in the pupil-teacher and pupil-staff ratios during the 1980s might have been due to a growth in the number of students receiving special education services and to an increase in the intensity of special education (namely, a decrease in the effective pupil-teacher ratio for special education). Although it is not possible to calculate directly special education intensity (because many of the students classified as disabled attend regular classes for much of the day), the impact of the special education changes on overall pupil-teacher and pupil-staff ratios can be estimated. Specifically, by assuming historical values for special education students, instructional staff, and classroom teachers, we can roughly approximate the impact of the growth in special education on the overall ratios.

As shown in Panel A of Table 4, the actual pupil-teacher ratio counting all students and teachers for the years 1980 and 1990 fell from 19.1 to 17.2—a decline of 10 percent. The second column estimates what the overall pupil-teacher ratio would have been in 1990 if the observed special education pupil-teacher ratio had

26. For these calculations we include teacher aides. Thus, this section differs from other calculations in the paper that exclude aides.

Table 4
Estimated Effects on Pupil-Teacher and Pupil-Instructional Staff Ratios of Changes in Special Education: 1980–90

A. Classroom Teachers

Year	Actual Pupil-Teacher Ratio	Overall Pupil-Teacher Ratio if Pupil-Teacher Ratio in Special Education Had Remained at 1980 Level	Overall Pupil-Teacher Ratio if Pupil-Teacher Ratio in Special Education and Proportion of Students Classified as Disabled Had Remained at 1980 Levels
1980	19.1	19.1	19.1
1990	17.2	17.6	17.9

B. Instructional Staff[a]

Year	Actual Pupil-Staff Ratio	Overall Pupil-Staff Ratio if Pupil-Staff Ratio in Special Education Had Remained at 1980 Level	Overall Pupil-Staff Ratio if Pupil-Staff Ratio in Special Education and Proportion of Students Classified as Disabled Had Remained at 1980 Levels
1980	15.8	15.8	15.8
1990	14.1	14.5	14.9

a. In this table, instructional staff includes teachers' aides. Consistent with prior tables, administrative personnel (supervisors) and bus drivers are excluded from special education staff.

remained at its 1980 level instead of falling. The last column shows what the 1990 pupil-teacher ratio would have been if, additionally, the proportion of students classified as disabled would have remained at its 1980 level instead of climbing as it did. The simulations indicate that most of the fall in the pupil-teacher ratio during this period was not caused by the expansion of special education. Even if the proportion of students classified as disabled and the observed special education pupil-teacher ratio had remained constant, the aggregate pupil-teacher ratio would have fallen to 17.9. In other words, by these calculations just over one-third of the fall in the pupil-teacher ratio can be attributed to increases in special education.

Panel B expands the consideration to include other instructional staff (which here differs from prior tables by including teacher aides). With the broader consideration, the potential effect of special education appears larger. Although the actual pupil-staff ratio fell from 15.8 to 14.1, as much as 0.8 or slightly less than half of this decline could have come from the expansion of the special education population and the increases in special education staff intensity.

The overall cost implications for special education can be put into perspective by employing estimates of the added cost of educating special education students.

The most detailed cost estimates of special education available are those of Chaikind, Danielson, and Brauen (1993). Although they demonstrate wide variation in the cost of different kinds of handicapping conditions, the weighted average across categories is that special education students cost approximately 2.3 times what regular education students cost. Table 5 traces the aggregate expenditure impact of the increases in spending per student and of the proportion of students receiving special education services over the decade of the 1980s, applying the estimate that special education costs 2.3 times regular education.[27] Viewing the average expenditure per student in 1980 (1990$) of $3,203 as a weighted average of regular and special education implies an average spending of $2,844 on regular students and $6,542 on special education students. By 1990, these had grown to $4,016 and $9,238 for regular and special education students, respectively. The bottom portion of Table 5 then calculates the base cost of public schooling (all students times the cost of regular education) and the additional cost of providing special education. It is important to recognize that between 1980 and 1990 special education costs increased because of both an increase in special education costs ($2,696 per student) and an increase in special education enrollment (an additional 652,000 students).

The final column of Table 5 provides estimates of changes over the 1980s. Total expenditure on public elementary and secondary school children increased by $54.1 billion, of which 82 percent resulted from increased spending per student on regular (base) education. The other 18 percent ($9.5 billion) resulted from the rise in special education costs due to both the increase in per-student costs and the growth in special education enrollment. Although special education students comprised only 11.6 percent of all students in 1990, they were responsible for 18 percent of the growth in total spending over the decade.

In sum, special education clearly accounted for less of the growth in educational resources during the 1980s than many assert. These aggregate decompositions do, however, mask substantial differences among school districts in the proportion of spending increases accounted for by special education. In an analysis of public education spending in New York State, Lankford and Wyckoff (1993) use state financial accounting reports to disaggregate spending in different categories between 1980 and 1992. Using a different decomposition approach than our own, they find somewhat larger proportions of increased funding going to students with disabilities in New York State. Outside of the largest five districts (New York City, Buffalo, Rochester, Syracuse, and Yonkers), 19.9 percent of the increased real spending between 1980 and 1992 is attributed to special education. The contribution of special education was higher in the largest school districts: 60.5 percent in New York City and an average of 24.3 percent in the four next largest dis-

27. The cost ratio of 2.3 represents an average across different handicapping conditions. Clearly this average will change over time, say with different intensity of treatment such as those indicated in Table 3. Moreover, there have been large changes in the mix of different conditions over time, and these changes will also affect the average costs of providing special education service. The most significant change has been the increase in the number of children with learning disabilities, a change that would work to reduce average cost (Reschly 1996, Lewit and Baker 1996). We have no way of adjusting costs over time for these various changes.

Table 5
Estimated Special and Regular Education Spending, Assuming Special Education Costs 2.3 Times What Regular Education Costs, 1980–90

	1980	1990	Change
Number special education students (1,000)	4,036.0	4,688.0	652.0
Percent all students in special education	9.7	11.6	1.9
Expenditure/student (1990 $s)			
All Students	$3,203.0	$4,622.0	$1,419.0
Regular students	$2,844.0	$4,016.0	$1,172.0
Special education students	$6,542.0	$9,238.0	$2,696.0
Aggregate public school expenditure (billions of 1990$)			
Base costs of education (all students)[a]	$118.4	$163.0	$44.5
Marginal special education expenditure for 1980 number of special education students[b]	$14.9	$21.1	$6.1
Marginal special education expenditure for added 1980–90 special education students (at 1990 expenditure level)[c]	—	$3.4	$3.4
Total expenditure	$133.4	$187.5	$54.1

a. Total students times average cost of regular student in each year.
b. Difference in cost of special education and regular students in each year times number of special education students in 1980. For example, for 1990, 4,036,000 × (9,238 − 4,016) = 21.1m.
c. Difference in number of special education students from 1980 base times marginal cost of special education in 1990. For 1990, (4,688,000 − 4,036,000) × (9,238 − 4,016) = 3.4m.

tricts.[28] Their estimates for New York do increase dramatically for the 1990s when overall spending growth slowed.

Rothstein and Miles (1995) examine special education expenditure for nine districts over the 1967–91 period, thereby covering the introduction of the Education for All Handicapped Children Act. They report that special education rose in these districts from 3.7 percent to 17 percent of total per-pupil spending. Their calculations for special education students in 1991 are consistent with special education costs, averaging slightly less than twice what other students cost, reinforcing the previous calculations.[29]

A variety of caveats and cautions are necessary. First, our calculations concen-

28. Their decomposition of real spending involves additive components for major spending categories in standard financial records. They do not break the growth in funding into components of numbers served and unit costs which would provide additional information given the fiscal incentives to increase the proportions of special education students in New York State. The relative contribution is also dramatically affected by overall growth in spending, because special education frequently is a priority spending area.
29. Their budgetary calculations do not provide information on the size of the population served. The calculations here employ national proportions consistent with those in Table 3.

trate just on the decade of the 1980s. During the 1970s the growth in expenditure that was related to special education was clearly larger. Before the 1975 legislation, many students in need of special services apparently did not even attend school.[30] Nevertheless, because of a lack of reporting requirements and data collection, it is not possible to get any overall estimates of the growth in expenditure in the 1970s that resulted from special education. Second, there are wide variations in the costs of different handicapping conditions which will affect these calculations, although it would appear that the largest recent growth in students has come in less expensive categories such as less severe learning disabilities. Third, the decomposition of growth would look different with stagnation in overall expenditure—which is the finding for the 1990s for New York State by Lankford and Wyckoff (1996).

The available data on special education lead to three conclusions. First, special education is noticeably more expensive than regular education and has accounted for a disproportionate share of the growth in school expenditure. Second, special education still explains only a small portion of total spending and of spending growth. Third, special education becomes more important in times of fiscal stringency, because the legal status of such spending dictates that it take precedent over regular education spending.

V. The Price (and Quality) of Teachers

The desire to reduce classroom sizes has increased the demand for teachers. At the same time, rising labor market wages for both college-educated men and, particularly, women have reduced teacher supply.[31] Because teachers constitute the vast majority of instructional staff, these supply and demand movements offer a straightforward explanation for the instructional staff price increase from $34 per day in 1890 to more than $183 per day in 1990, an increase that accounts for more than 40 percent of the increase in total expenditure on instructional staff over the century. But they tell only part of the story, because schools have also been able to adjust the average quality of teaching personnel by shifting teacher salaries to accommodate shifts in supply and demand. Because potential teachers clearly differ in their skills and consequently their alternative wage opportunities, any increase (or decrease) in teacher wages beyond that occurring in other sectors reflects a change in where teachers are drawn from the distribution of workers, and this would be expected to influence teacher quality in the long run.[32]

30. For students not attending school, the marginal cost of adding the student would be the full cost of a special education student less any governmental expenditure on the student through other programs such as special institutions. No data are available on either the increase in students resulting from the legislation or the alternative costs (governmental or private). Rothstein and Miles (1995) attempt to estimate special education spending for their nine districts before the federal legislation, but, as they discuss, both different reporting and different approaches to education make this task difficult.

31. For a formal analysis of teacher supply and demand, see Flyer and Rose (1994).

32. This is not to say that nonpecuniary factors are unimportant in determining whether individuals choose to teach. Rather, we assume that nonpecuniary benefits or costs of teaching have not changed

To trace teacher quality changes, we use annual earnings data for teachers taken from the six decennial population censuses between 1940 and 1990.[33] Annual earnings, which includes money teachers receive in teaching and in other occupations, obviously goes beyond comparing pure teacher salaries to salaries in other occupations. We believe that, although more common, using just teaching salaries concentrates on the wrong comparison, because teachers enjoy much longer vacations than most other workers. Overall earnings better reflect the monetary benefits of being a teacher as opposed to having a different primary occupation.[34] Private school and public school teachers are also grouped together, but, because a roughly constant 10 percent of students attended private schools throughout the period, it is unlikely that movement in the earnings of private school teachers had a significant impact on the overall relative wages of teachers.

Teacher earnings are compared to the earnings of those who do not teach. Specifically, the location of average teacher earnings in the distribution of nonteacher earnings is our primary measure of potential teacher quality. The lower the percentage of nonteachers who earn less than the average teacher, the relatively worse teaching jobs are when compared to alternative occupations. The use of percentile rankings as opposed to a comparison of mean earnings reduces problems associated with the Census top-coding of incomes and lessens the impact of changes in the tails of the nonteacher earnings distribution.[35]

The movements in relative earnings of teachers have been dramatic, but, as shown in Table 6, differ noticeably between men and women. Although the average male teacher earned more than 84 percent of all males in 1940, this fell to 64 percent by 1990. All of this relative fall, however, occurred before 1960, and, following a slight dip in the 1970s, male teachers have been moving up the earnings distribution. The overall decline in the relative position of women teachers has been almost as large, though female teachers are still better positioned in the earnings distribution than male teachers. But the time path of the decline for females has been very different, with the largest fall occurring after 1970, when the average teacher moved a full 10 percentage points down the earnings distribution.

These aggregate figures provide information on movements in the position of average teacher earnings, but they obscure more fundamental changes in the

in comparison to those in other occupations, in which case changes in relative earnings functions as a good index of where teachers fall in the labor force. The influence on the stock of teachers from a change in wage rates is actually complicated, depending on the choices of school districts and the behavior of prospective teachers; see Ballou and Podgursky (1995) for consideration of various outcomes from wage changes.

33. The category is defined as all teachers below the post-secondary level. As such, it includes, some preschool teachers, but these people cannot be separated out before 1980. In the 1980 census data, 97 percent of all included teachers were primary and secondary teachers.

34. Broad occupations clearly differ in a variety of nonmonetary ways including fringe benefits and average length of workday and work year. This analysis assumes that the relative importance of these over time has remained constant between teaching and other occupations. Rothstein and Miles (1995) suggest that benefits for teachers rose faster than those for the rest of the economy between 1967 and 1991, although, as they point out, such comparisons are difficult to make with a high degree of reliability.

35. Preliminary work further shows that the qualitative changes for mean earnings comparisons follow a similar pattern to the percentile movements. See also the aggregate comparisons of mean earnings in Table A1.

Table 6
Position of the Average Teacher in the Nonteacher Earnings Distribution by Gender, 1940–90

	Percent of Male Nonteachers Earning less than Average Male Teacher		Percent of Female Nonteachers Earning less than Average Female Teacher	
Year	All Workers	College Graduates	All Workers	College Graduates
1940	84.0	52.5	92.3	68.7
1950	73.4	36.2	86.7	55.0
1960	63.3	28.7	86.9	52.7
1970	62.2	25.7	85.8	47.1
1980	53.0	31.0	77.7	50.1
1990	64.0	36.5	75.1	45.3

Source: U.S. Decennial Censuses of Population, Public Use Microdata: 1940–90.

salary structure of teaching relative to other occupations because they mix together earnings changes relevant to individual workers with aggregate changes in the education levels and age structure of all workers and of teachers. For example, an increase in the average age of teachers relative to nonteachers would raise the position of the average teacher even if the teacher salary structure did not improve in comparison to other occupations. We separate movements in relative earnings for workers at different age and education levels from compositional changes in the workforce. When we do this, we find noticeably different patterns of relative earnings changes than appear in the aggregate.

Specifically, we decompose movements in average teacher earnings along the nonteacher earnings distribution into four factors: (1) pure changes in earnings for teachers and nonteachers (given age and education); (2) increases in college completion rates for nonteachers; (3) changes in the average age distribution for all workers; and (4) changes in the age distribution of teachers relative to nonteachers. To accomplish this decomposition, we divide teachers into four age groups (20–29, 30–39, 40–49, and 50–59) and divide nonteachers into eight groups by these age categories and by education (college-educated and all others). The mean earnings of teachers equals a weighted average of mean teacher earnings in each age cell; the percentage of nonteachers whose incomes fall below the overall teacher mean equals a weighted average of the percentage in each age-education cell whose incomes fall below the overall teacher mean. Changes over time in the percentage of nonteachers who earn less than the average teacher result from within-cell shifts in the earnings distribution (*pure wage changes*) and from changes in the age composition of teachers and the age-education composition of nonteachers. Each factor's contribution to changes in the earnings position of teachers is estimated by calculating a series of counterfactual earnings distributions based upon different compositions of workers. Males and females are considered separately.[36]

Consider, for example, the changes in the relative earnings of women teachers between 1940 and 1990. Table 6 shows that between 1940 and 1990 the average woman teacher fell from the 92.3 percentile to the 75.1 percentile on the nonteacher earnings distribution, a 17.2 percentage point decline. Table 7 decomposes this overall change into underlying distributional movements. If only the within-cell earnings distributions had changed (pure wage changes) but the age distribution of teachers and age/education distribution of nonteachers had stayed at their 1940 values, the average teacher would have fallen to the 80.4 percentile. Thus the use of fixed 1940 cells weights assigns 11.9 percentage points of the decline to pure earnings changes. This might be described as the ex post Scitovsky-Baumol effect, because it represents the increasing labor earnings in other sectors and the net result of schools' reaction to such gains. If, in addition, the college completion distribution had changed to its 1990 value without altering the age distribution of teachers or nonteachers, the average teacher would have fallen to the 74.1 percentile, implying that the shift in the education distribution of nonteachers contributed 6.3 percentage points of the change. If, in addition, the age distribution of nonteachers had adjusted to its 1990 value and the age distribution of teachers had changed the same number of percentage points in each cell as had the age distribution of nonteachers, the average teacher would lie on the 75.2 percentile, implying that the change in the age distribution of all workers accounted for an improvement in the position of teachers of 1.1 percentage points. Finally, the difference between 75.2 and the actual 1990 value of 75.1 equals 0.1 percentage points, indicating that changes in the teacher age distribution vis-à-vis that for nonteachers had little impact.

For men, the early postwar period of 1940–70 saw a dramatic deterioration in the position of teachers. Of the 21.8 percentage point fall down the male nonteacher earnings distribution, pure wage changes accounted for 15.1 percentage points. In contrast, pure wage changes accounted for a much more modest 4.2 percentage points of the overall decline of 6.5 percentage points for women teachers. This gender difference reflects the much more significant earnings increases outside of teaching for men than for women. The large number of teachers who were hired during the 1960s in response to the demand for smaller classes and a rapidly growing student population also lowered the age composition of teachers in comparison to other workers, contributing an additional 2.7 and 3.6 percentage points to the decline for female and male teachers, respectively.

The years 1970 to 1990 appear to provide a sharp contrast to the earlier period: average female teacher earnings fell 10.7 percentage points to the 75.1 percentile, while average male teacher earnings actually rose by 1.8 percentage points. But

36. Two primary reasons dictate the separation by gender. First, alternative opportunities for women differ from those for men. Women had opportunities inferior to those of men throughout the period, though their opportunities clearly improved relative to men as time passed. Second, on average women have less labor market experience than men of the same age, because they are more likely to remain out of the labor force for extended periods of time.

Table 7
Sources of Decline in Position of Average Teacher in Distribution of All Workers: by Gender, 1940–90

	1940–70	1970–90	1970–80	1980–90	1940–90
Men					
Pure wage changes	−15.1	−6.2	−13.8	5.4	−21.6
Changes in education levels of nonteachers	−3.1	−3.5	−1.7	−1.5	−5.9
Changes in overall age distribution	0.0	−1.0	−1.0	3.0	−0.7
Relative changes in teachers' age distribution	−3.6	12.5	7.3	4.1	8.2
Total percentage point change in men below average male teacher	−21.8	1.8	−9.2	11.0	−20.0
Women					
Pure wage changes	−4.2	−8.8	−6.7	−2.2	−11.9
Changes in education levels of nonteachers	−0.9	−5.1	−2.0	−2.8	−6.3
Changes in overall age distribution	1.3	−2.8	0.0	−1.2	1.1
Relative changes in teacher's age distribution	−2.7	6.0	0.6	3.6	−0.1
Total percentage point change in women below average female teacher	−6.5	−10.7	−8.1	−2.6	−17.2

a big part of the gender difference in aggregate change over this 20-year period comes from the much greater aging of male teachers. Male teachers moved up 12.5 percent in the earnings distribution simply because they aged significantly as a group compared to nonteachers. (Male teachers aged 20–40 made up 68 percent of all male teachers in 1970, but this fell to 41 percent in 1990). The age composition effect for female teachers was also significant (6 percent), but noticeably smaller than that for male teachers. The pure wage effects were more similar, with females slipping 8.8 percent and males 6.2 percent. Men and women teachers also fell in the overall distribution because nonteachers increased in overall education levels. Changes in education implied a 3–5 percent decline in the overall relative position of teachers.

The period 1970 to 1990 is actually made up of two distinctly different decades. During the 1970s, the relative earnings of teachers plummeted, due in large part to the decline in the earnings premia for college-educated workers.[37] Earnings changes for teachers were much more favorable during the 1980s when shifts in the wage structure resulted in a 5.4 percentage point increase in the position of men and only a 2.2 percentage point decline for women due to pure wage changes. The continued relative earnings decline for women teachers, despite their substantial real wage increases during the 1980s, resulted from civil rights legislation, technological changes, and other factors that expanded employment opportunities and led to commensurate wage increases for all women–factors incorporated into the analysis of Flyer and Rosen (1994).

The implication of these changes during the last 50 years is that teachers have been drawn from further down the overall nonteacher earnings distribution. The instructional staff price increase described earlier was therefore far below a magnitude necessary to maintain teacher salaries at their historical locations in the earnings distributions of men and women. To maintain the same relative positions in 1970 as in 1990, female real teacher salaries would have had to increase by an additional 20 percent (although male salaries would not have had to increase).

The large number of teachers who will retire during the 1990s will reduce the total teacher salary bill as new entrants replace more highly paid teachers, but at the same time it is younger women who have enjoyed the largest earnings increases outside of teaching. Figure 3 plots the position of men and women teachers in the nonteacher and college graduate nonteacher wage distributions for new entrants 20- to 29-years-old. Two aspects stand out. First, young female teachers' wages have deteriorated compared to the wages of nonteaching females, whether college graduates or not. Second, the relative position of females is fast approaching that of males, suggesting that counting on a continual supply of high-quality female teachers may not be reasonable in the future. These wage changes will put new pressures on schools, because women made up 68 percent of all teachers in 1990 (Table A2). The percentage female in 1990 was up over that of previous decades, perhaps reflecting the continued lower attractiveness of teaching for males and the influence of expanded female labor supply—situations that are now changing.

Whether the decline in relative teacher earnings has been good educational policy and should be continued depends upon how much teacher performance and educational output would have been improved by the payment of higher salaries. Although it may be natural to expect that a decline in teacher quality follows directly any decline in relative teacher earnings, the true effect depends on a number of unmeasured factors including the substitutability between teaching skill and other activities and the ability of schools to hire and retain effective teachers. On this question the empirical evidence is mixed. Murnane et al. (1991) find that higher salaries tend to retain higher IQ teachers. On the other hand, Ballou (1996) finds little evidence that public schools hire the most skilled teacher applicants, and Hanushek and Pace (1995) find little salary reponsiveness of college students training to be teachers.[38] Nevertheless, there seems to be little

37. The differences between men and women over the decades reflect differential changes in the college wage premia; see Murphy and Welch (1989, 1992) and Hanushek et al. (1994).

38. The educational production function studies on the relationship between student outcomes and either

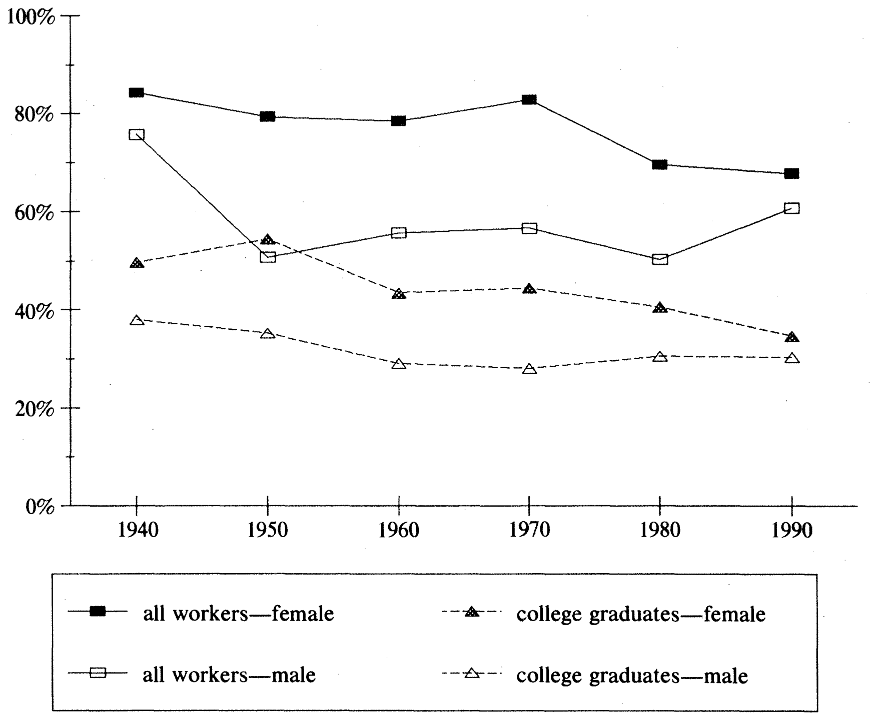

Figure 3
Percent Nonteachers Earning Less than Average Teacher, by Gender and Education for Individuals Age 20–29

doubt that a large fall in relative teacher earnings over a long period of time will eventually exert a depressing effect on school quality.

One of the most profound changes in schools over the past few decades may be the changing female labor market, as women, the mainstay of the teaching force, have been bid away by other professions.[39] Moreover, if allowed to continue, the dramatic changes at entry level—where the relative position of male and female teachers is now very similar—suggest even larger changes. The prospects for large numbers of retirements over the next decade coupled with the now present salary disadvantages of teaching could lead to large swings in the quality of the teaching force over a short period of time.

teacher salaries or the determinants of teacher salaries also find no clear evidence that higher salaries improve outcomes (Hanushek 1986, 1989). These studies, however, indicate the impact of movements along the salary schedule rather than the implications of shifts in the entire schedule.

39. The trends in teacher salaries and labor market competition for the most able women may in fact be major components of achievement score declines in the 1960s and 1970s, although explicit evaluation of this relationship is not possible. See Congressional Budget Office (1986, 1987) for more discussion of achievement trends and explanations.

VI. Other (Noninstructional Staff) Expenditure

The preceding analysis concentrated entirely on instructional staff salary expenditure. Yet, as Table 1 and Figure 1 show, other expenditures have actually risen more rapidly over the entire century. Other expenditure grew from $0.4 billion in 1890 to $6.4 billion in 1940 and to over $100.0 billion in 1990. On average, since 1960, these combined added expenditures per student rose at 5 percent per year, compared to only 3 percent per year for instructional staff expenditure. The relative growth of other expenditure was most rapid during the decade of the 1970s, a period when the total school age population dropped significantly.[40]

Increasing numbers of students and rising real wages of high-skilled individuals surely contributed to the growth in other expenditure over the entire period, but additional changes also must have been important. If, for example, other expenditure had grown at the same per-student rate as instructional salary expenditure between 1960 and 1990, the 1990 per-student expenditure would have been $3,480 instead of over $4,622. Moreover, this calculation implicitly allows for increased noninstructional intensity because the growth in instructional expenditure includes a fall in the pupil-staff ratio of a third.

The attention that is given to other expenditure flows in part from a common interpretation that, if it does not relate to instructional staff, it is simply the growth of administrative bureaucracy.[41] Unfortunately, it is difficult to tell exactly what changes have occurred, let alone to judge the efficacy of any such changes. Little consistent data are available to permit any detailed analysis of what lies behind this growth. Moreover, the data that do exist are somewhat misleading, because the other category actually includes a variety of items that are conceptually part of instructional expenditure but are labeled noninstructional by accounting convention.

Table 8 shows the overall distribution of expenditure by purpose for the year 1960 to 1990.[42] The two fastest growing categories as a percentage of noninstructional expenditure are "fixed charges" and "other instructional" expenditure. The bulk of fixed charges involves recurrent benefits for staff retirement and health insurance; therefore a substantial portion of these costs actually belong in

40. In terms of absolute growth rates, the decades of the 1950s and 1960s are the largest of the postwar period; this holds for both per-capita expenditure and total current expenditure. During these decades, however, both instructional staff and other expenditure were growing in parallel. During the 1970s, instructional staff expenditure was constant in the aggregate and rose less than 1 percent annually on a per-student basis, although other expenditure per student grew at an annual real growth rate of 5.6 percent.

41. For example, former Secretary of Education William J. Bennett writes, "Too much money has been diverted from the classroom; a smaller share of the school dollar is now being spent on student classroom instruction than at any time in recent history. . . . It should be a basic goal of the education reform movement to reverse this trend toward administrative bloat and to reduce the scale of the bureaucratic 'blob' draining our school resources." (Bennett 1988, p. 46).

42. The 1990 data are less disaggregated than previous years, which is unfortunate because noninstructional staff spending actually declined slightly as a proportion of total expenditure during the 1980s.

Table 8
Percentage Distribution of Current Expenditures: 1960–90

	Instructional Staff	Other Instructional	Central Administration	Maintenance	Fixed Charges	Other	Total
1960	61	7	4	12	7	9	100
1970	57	11	5	10	10	7	100
1980	46	15	5	11	14	9	100
1990	46	12		42[a]			100

Source: *Digest of Education Statistics* (1992). "Other Instructional" equals instructional expenditure minus instructional staff salaries.
a. Costs for administration, plant maintenance, and fixed charges are not serparately available for 1990.

the instructional staff category. Rothstein and Miles (1995) suggest from an intensive analysis of a set of nine school districts that teacher benefits doubled as a proportion of total compensation over the period 1967–91, underscoring the somewhat arbitrary division of expenditure categories. If the growth in benefits from Rothstein and Miles can be generalized to all schools, about half of the decline between 1970 and 1990 in instructional salary as a proportion of total expenditure would be eliminated—yielding the more modest change of instructional compensation falling from 63 to 57 percent instead of the 46 percent depicted in Table 8.

Other instructional expenditure includes the costs of learning materials and school-level support staff. The rapid rise in other instructional expenditure between 1960 and 1980 is consistent with a very substantial growth in school-level clerical and support staff. During this period, Title I was passed, special education was introduced through federal legislation, and court ordered desegregation activity was at its peak. The growth in the number of teacher aides from 57,000 in 1970 to 326,000 in 1980 (National Center for Education Statistics 1995) was undoubtedly linked to the expansion of these programs during the 1970s. (The number of aides showed a much more modest increase during the 1980s). Unfortunately, the available evidence does not permit an accurate assessment of the contributions of these programs to the overall growth in other instructional expenditure.

The only separately identified category for administration (or, possibly, bureaucracy) is expenditure on central administration, which includes all administration that is outside of the school. Central administrative costs have remained at roughly 5 percent of total expenditure throughout the time period covered. All increases in instructional staff usage have thus been accompanied by proportional increases in administration. The same is true for plant maintenance and the residual category "other." The latter includes transportation costs, which rose substantially during this period,[43] but the fact that transportation costs are small relative to other types of expenditure indicates that their growth has not had a large impact on overall costs.

Lack of detailed and consistent data on basic components of school spending outside of salaries is indeed unfortunate, particularly given the current magnitude of such expenditure. Nonetheless, except noting the importance of such things as accounting conventions for personnel benefits, little explicit analysis of the aggregate data is possible.

VII. Postscript to the Future

This analysis has focused on cost changes between 1890 and 1990. Additional data provide some indication of the future course of school expenditure, given the developments of the 1990s. Perhaps the most significant fact is that the growth rate in expenditure per student fell precipitously, it seems, in the early 1990s. Although real spending per pupil grew at a 3.75 percent real annual rate in the 1980s, there was essentially no growth from 1990 through 1994 (National Center for Education Statistics 1995). This changed fiscal environment may be consistent with the hypothesis expressed earlier that the return to a growing student population, which began in 1985, would put pressure on overall spending increases. Nonetheless, more observations will be required to establish any trend and to relate spending to other cost pressures.

One immediate impact of this slowed growth in spending is that special education spending—which appears to have a different dynamic—becomes relatively more important. Because of the mandated status of much special education spending, expansion of special education in either scope or intensity takes a larger share of any new money when there is lessened total budgetary growth. Indeed, even though the student population grew in the early 1990s, the special education population continued to grow more rapidly. The percentage of children classified as disabled increased from 11.6 percent in 1990 to 12.0 percent in 1993 (National Center for Education Statistics 1995).

Such increased relative importance of special education is just the finding of Lankford and Wyckoff (1996) in their analysis of budgetary changes for New York State in the early 1990s. In their analysis, as overall growth in budgets slowed, special education consumed a greater proportionate share of increases. The extreme was New York City, where the fiscal absorption of special education was magnified both by rapidly growing spending per special education student and slow growth in the district's overall spending per student. This channeling of funds toward special education could add to voters' apparent discontent with spending growth in the 1990s.

43. The percentage of pupils transported at public expense increases from 16.3 percent in 1940 to 27.7 percent in 1950, 37.6 percent in 1960, 43.4 percent in 1970, 56.7 percent in 1980 and 61.3 percent in 1988. Transportation costs account for approximately 20 percent of "other" expenditures (National Center for Educational Statistics 1995).

VIII. Conclusions

Changes in public school enrollment have substantially affected educational expenditure. But even if the student population had remained constant throughout the last 100 years, expenditure would have risen by a factor of 25. Although special factors have had relatively greater impacts at different points in time, three stand out as being of primary importance throughout the entire period: (1) the rising price of instructional staff; (2) the declining pupil-teacher and pupil-staff ratios; and (3) rising noninstructional staff costs.

The rising price of instructional staff was driven largely by the substantial growth in real wages over the last 100 years. One reaction to external pressures from increased earnings has been a deterioration in the quality of teachers, as measured by position in the income distribution. Thus, the adjustment to Scitovsky-Baumol cost pressures has been through allowing teacher quality to drift downward and not through any substitution away from teachers as would occur with either increases in class size or expanded use of technology. The sudden and recent declines in the relative salaries of female teachers, reflecting expanded outside opportunities, are particularly noticeable and are likely to be felt increasingly in the future. The reduction in the financial attractiveness of teaching that has already occurred is understated by aggregate comparisons between teachers and nonteachers because the aggregate data commonly employed are heavily influenced by compositional changes, particularly in the age distribution of teachers. A second reaction of schools, which is less explicable from a pure cost viewpoint, is that schools have used their increasingly expensive labor resources more intensively.

The expansion of education for handicapped children has led to disproportionate spending on special education, but–until quite recently–the primary driving force on school expenditure has still been regular education. With the dramatic slowdown in spending in the 1990s and with the legal priority of special education spending, a new reality is dawning. Further, although the cost picture is reasonably clear, virtually no discussion of outcomes from special education programs or of the relative balance between special and regular education programs has taken place.

The falling student enrollment in the 1980s allowed per-student expenditure to rise faster than total spending (and, presumably, tax rates), but this fortuitous situation has ended and reversed. At the same time, tighter local government budgets and expanding employment opportunities for women will place even greater pressure on school district budgets. These may, as already foreshadowed in the early 1990s, spell continuing fiscal difficulty for schools as citizens and voters inevitably become more concerned about costs and the returns on investments in public education.

Appendix 1

Data Sources

The data series used in this analysis were spliced together from a number of sources. Because the various government statistics use inconsistent definitions over time, a number of modifications to the existing series were necessary in order to construct consistent time series for the 100-year period. The basic sources for the variables in Table 1 are: 1890–1970, *Historical Statistics of the United States* (Series H); 1972–90, *Digest of Education Statistics* (various years). Data on private school enrollment come from the *Statistical Abstract of the United States* (various years). The population of 5–19-year-olds comes from the U.S. Census of Population. The basic source of data for Table 3 with the numbers of disabled children, special education teachers, and other special education personnel is the U.S. Department of Education, *To Assure the Free Appropriate Public Education of All Children with Disabilities* (Thirteenth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 1991 and various other years of this annual report). The data on teacher salaries relative to other salaries in the economy were calculated from the public use microdata files of the U.S. Census of Population for 1940 through 1990.

Notes on specific series:

(1) In 1890 total current expenditure includes interest expenditures (which were less than 3 percent of the total and declining in 1918, the first year when interest expenditures were separately identified).

(2) For 1890 the average salary for instructional staff is computed for teachers only, though for 1990 the average salary calculations include teacher aides as instructional staff.

(3) Instructional staff equals the sum of classroom teachers, librarians, principals, guidance counselors, assistant principals, and psychologists. The number of psychologists in 1990 was taken from the IDEA table on special education personnel, because it was not separately reported in the Digest. For years in which the number of psychologists was listed in both the IDEA and the Digest, the numbers were quite similar.

(4) Between 1978 and 1987 "special education teachers" referred to teachers of children 0–21 years old. Following 1987 the IDEAs report the number of teachers of children 6–21 years old. The post-1987 figures are adjusted upwards by a factor of 0.159, which produces a pupil-teacher ratio in 1988 that is identical to the pupil-teacher ratio in 1987. The actual pupil-teacher ratios in 1986 and 1987 were virtually identical, as were the pupil-teacher ratios in 1989 and 1990, making it highly unlikely that this adjustment introduced substantial error into the 1990 estimate of the number of special education teachers.

(5) Special education personnel other than classroom teachers are divided into "Other Instructional" and "Noninstructional Personnel." All supervisors are included in the category "Noninstructional Personnel."

Table A1
Average Teacher Earnings Relative to Average Nonteacher Earnings, by Gender, 1940–90

Year	Average Male Teacher Compared to Average Male Nonteachers: All Workers	Average Male Teacher Compared to Average Male Nonteachers: College Graduates	Average Female Teacher Compared to Average Female Nonteacher: All Workers	Average Female Teacher Compared to Average Female Nonteacher: College Graduates
1940	1.38	0.75	1.67	1.01
1950	1.09	0.67	1.34	0.99
1960	1.08	0.69	1.44	0.96
1970	1.07	0.70	1.45	0.91
1980	0.92	0.67	1.25	0.88
1990	0.94	0.65	1.18	0.80

Source: U.S. Decennial Censuses of Population, Public Use Microdata: 1940–90.
Note: All comparisons are weighted by age distribution of nonteachers.

Table A2
Employment in Teaching, by Gender, 1940–90

Year	Percent of Males Employed in Teaching Among: All Workers	Percent of Males Employed in Teaching Among: College Graduates	Percent of Females Employed in Teaching Among: All Workers	Percent of Females Employed in Teaching Among: College Graduates	Percent of All Teachers Who Are Female
1940	0.6	6.9	2.8	31.0	63
1950	0.7	8.0	3.2	33.0	62
1960	1.2	9.6	3.7	39.2	54
1970	1.5	9.6	4.6	41.3	57
1980	1.7	7.4	4.8	26.3	62
1990	1.6	5.7	4.9	18.7	68

Source: U.S. Decennial Censuses of Population, Public Use Microdata: 1940–90.
Note: All comparisons are weighted by age distribution of nonteachers.

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