# How Much Does School Spending Depend on Family Income? The Historical Origins of the Current School Finance Dilemma

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Financing for U.S. elementary and secondary schools is in the throes of two crises, both of which are likely to affect the economy over the long term. The first is a crisis over the relationship between family income and per-pupil spending: to what degree should parents' income determine the amount of money spent on a child's elementary and secondary education? The answer is not only important for reasons of distributive justice. It may also be important for macroeconomic growth because it is not generally efficient to base human-capital investment in a child on the income of his parents (Michele Boldrin, 1993; Roland Benabou, 1996; Raquel Fernandez and Richard Rogerson, 1996). This question lies at the heart of cases filed over the constitutionality of states' school-finance systems (see Thomas Downes, 1992; Hoxby, 1995; William Evans et al., 1997).

The second crisis in school finance is over the property tax, which is the traditional and dominant source of revenue for public elementary and secondary education. The property tax can have good economic properties under optimal conditions (functioning as a user fee), but political dissatisfaction with the property tax is rising. Michigan largely eliminated it as the basis for school finance in 1994.

This paper explores the origins of these school-finance problems. Using data from 1900 to 1990, I investigate three questions. Has the distribution of per-pupil spending in the United States grown more or less unequal over time? Has the relationship between per-pupil spending and property value changed? Finally, has the relationship between parents' income and per-pupil spending become stronger or weaker over time? Underlying the questions is a classic puzzle about revolutions: are the current crises due to increasing failure of the system or to rising expectations about what a school-finance system should be able to achieve?

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## I. Empirical Strategy

The questions posed require district-level data and a historical view. Data that fulfil these requirements must be gathered in a painstaking way from state archives because, until 1970, the federal government only gathered district-level data for large cities. This paper employs district-level data for Massachusetts, Illinois, and California—states chosen for data quality and representativeness (unfortunately, no Southern state could be included). School districts' records provided the data on expenditures, number of pupils, and local equalized property valuation. The U.S. Census of Population, aggregated to the same jurisdictional level as the school district whenever possible, provided the demographic data. (For pre-1970 censuses, small rural districts can sometimes only be matched to the rural portion of their county). Demographics include household incomes and the age distribution of the population. The data are described in detail in Hoxby (1998).

For studying school finance, it is essential to focus on *fiscal* school districts, that is, districts that have significant autonomy in revenue-raising and expenditure. They are the appropriate units to match with data on property values and per capita incomes. Fiscal districts should not be confused with attendance districts, which do not independently raise taxes or determine expenditures.

Each state started the century with a system based largely on local property taxes, although California's fiscal districts have always been substantially larger than those of Massachusetts and Illinois. Over time, all three states have given more control over school finance to the state government, but the state

governments have continued to rely on the property tax. By 1970, the states were using forms of foundation aid, which puts a floor under per-pupil spending by redistributing funds from districts with high property valuation per pupil to districts with low property valuation per pupil. Since then, Illinois and Massachusetts have done an increasing amount of redistribution, but maintained some local autonomy. The second Serrano decision caused California to move to statewide school finance during 1978–1980, so that the state now has one fiscal district allocating funds on a strict per-pupil basis over the vestigial (attendance) districts. Analyzing California is useful because, of the 50 states, it has had the most dramatic crisis and change in school finance. Thus, one might expect it to show the factors that generate a crisis.

## II. Results

Table 1 presents a measure of inequality in per-pupil spending, the enrollment-weighted coefficient of variation.[1] The table shows that inequality in per-pupil spending was relatively stable from 1900 to 1990. The coefficient of variation is typically about 0.2, meaning that a standard deviation in per-pupil spending is about 20 percent of the mean. The student who experiences per-pupil spending at the 95th percentile goes to a school that spends about 60 percent more than the student at the 5th percentile. The difference between the 90th and 10th percentiles is about 45 percent, and the difference between the 75th and 25th percentiles is about 30 percent. Whether this amount of inequality is small or large depends on whether the standard of comparison is absolute equality or income inequality (which is much larger, as will be seen).

None of the measures of inequality varies dramatically over the century: the difference between the maximum and minimum coefficients of variation in per-pupil spending is about 8 percent. Nevertheless, there is a definite time pattern. Spending inequality was stable between 1900 and 1910, fell to a slightly lower level in 1920 and 1930, and widened again during the Great Depression. Inequality bottomed out in 1950, rose slightly between then and 1970, rose significantly between 1970 and 1980, and was relatively stable during the 1980's. Thus, if one looks at data from 1900 to 1950, spending inequality mainly appears to be falling. The reverse is true after 1950. Whether 1950 is a good benchmark depends on the purpose of the analysis. If we look at the entire century, spending inequality is surprisingly stable: current spending inequality is similar to that of 1900, 1910, 1940, and 1980.

TABLE 1—PER-PUPIL SPENDING INEQUALITY AMONG DISTRICTS, MEASURED BY THE COEFFICIENT OF VARIATION

| Year | MA | IL | CA |
|---|---|---|---|
| 1900 | 0.21 | 0.27 | 0.17 |
| 1910 | 0.21 | 0.26 | 0.18 |
| 1920 | 0.18 | 0.22 | 0.17 |
| 1930 | 0.18 | 0.21 | 0.16 |
| 1940 | 0.25 | 0.28 | 0.18 |
| 1950 | 0.16 | 0.21 | 0.15 |
| 1960 | NA | NA | NA |
| 1970 | 0.18 | 0.25 | 0.16 |
| 1980 | 0.24 | 0.28 | — |
| 1990 | 0.25 | 0.28 | — |

There is an obvious parallel between the time pattern in spending inequality and that of economy-wide income inequality. In particular, the two decades in which spending inequality rose the most (the 1930's and the 1970's) were also decades of rising income inequality. The decade in which spending inequality fell the most (the 1940's) was a decade of falling income inequality.

Massachusetts, Illinois, and California all exhibit similar time patterns, but Illinois began with higher spending inequality than Massachusetts. California consistently had the lowest and least fluctuating spending inequality, probably because its large fiscal districts included a wider array of occupations and industries. The surprise is that California's

[1] Hoxby (1998) shows that similar patterns are obtained if Gini coefficients, log percentile spending ratios, or other measures of inequality are used instead of the coefficient of variation. Data for 1960 were not available. Weighting by enrollment is important for making comparisons over time because some districts have consolidated, and population densities have shifted. The Massachusetts data are consistently the highest in quality.

relatively stable and uniform per-pupil spending was more severely criticized during the decade from 1966 to 1976 than that of other states (certainly more than that of Massachusetts or that of Illinois). Of the three states, California apparently offered the least cause for complaint prior to its dramatic shift to state-level school finance.

Table 2 shows inequality of per-pupil valuation, using the enrollment-weighted coefficient of variation. Equalized property valuation (the valuation the state uses to calculate aid) is used. Per-pupil valuation is much less equal than per-pupil spending. A standard deviation in per-pupil valuation was between 55 percent and 65 percent of the mean from 1900 to 1990. Unlike inequality in per-pupil spending, there has been a long downward trend in the inequality of per-pupil valuation. The same fluctuations (more inequality in 1940, 1980, and 1990; less inequality in 1950) surround the negative trend. The downward trend is most obvious in Illinois, where the coefficient of variation fell from 65 percent in 1900 to about 45 percent during 1980–1990.

What explains the downward trend? The most likely explanation is the decline in arbitrary differences in districts' per-pupil valuation due to lumpy real-estate assets (like family-owned farms with few children residing on them). Over time, taxation of these assets has become increasingly distinguished from taxation of house property, both because of tax-law changes and because these assets have become corporate property. Districts have also consolidated, spreading these assets over a larger number of children.

The key implication of Table 2 is that the relationship between per-pupil spending and per-pupil valuation is not rigid. If it were rigid (if local residents did not modify their choice of property-tax rates depending on the relationship of local real-estate assets to incomes), then inequality in per-pupil spending would have fallen notably between 1900 and 1990.

The next step is to net out the effects of economy-wide income inequality on the inequality of per-pupil spending and valuation. This will allow me to focus on whether school-finance systems are operating differently over time or whether the systems are merely operating similarly in different environments. If the coefficients of variation in Tables 1 and 2 are adjusted by dividing by the overall coefficient of variation in income (income inequality in a state and year, based on the entire population and taking no account of school districts or pupils), the fluctuations in the inequality of spending and valuation per pupil are greatly dampened.[2] For Massachusetts from 1900 to 1990, the adjusted per-pupil spending series is nearly flat, and 1950 is not the nadir: 0.11 (1900), 0.12 (1910), 0.10 (1920), 0.12 (1940), 0.11 (1950), 0.11 (1970), 0.12 (1980), and 0.12 (1990). Adjusting per-pupil valuation makes the long-term fall in the inequality of per-pupil valuation more obvious. The series for Illinois is: 0.33 (1900), 0.35 (1910), 0.32 (1920), 0.25 (1940), 0.25 (1950), 0.24 (1970), 0.24 (1980), and 0.24 (1990).

TABLE 2—PER-PUPIL VALUATION INEQUALITY AMONG DISTRICTS, MEASURED BY THE COEFFICIENT OF VARIATION

| Year | MA | IL | CA |
|---|---|---|---|
| 1900 | 0.60 | 0.65 | 0.50 |
| 1910 | 0.55 | 0.62 | 0.48 |
| 1920 | 0.41 | 0.58 | 0.41 |
| 1930 | 0.41 | 0.57 | 0.40 |
| 1940 | 0.38 | 0.49 | 0.42 |
| 1950 | 0.37 | 0.41 | 0.36 |
| 1960 | NA | NA | NA |
| 1970 | 0.45 | 0.41 | 0.36 |
| 1980 | 0.48 | 0.45 | 0.39 |
| 1990 | 0.51 | 0.46 | 0.40 |

Replication of Tables 1 and 2 for income per capita, (as opposed to spending and valuation per pupil) can only be done in a completely parallel manner for 1970 to 1990, because the availability of household-income data on the district level varies prior to these years. Table 3 shows the results of this exercise. The upper part of the table shows that between-district income inequality rose

[2] The series used for the denominator were calculated using Integrated Public Use Micro Sample data, which are available for every Census year in this century except 1930. Incomes for 1900, 1910, and 1920 were estimated from regressions of 1940–1960 wage and salary income to indexes of occupational status.

TABLE 3—PER CAPITA INCOME INEQUALITY AMONG DISTRICTS, MEASURED BY THE COEFFICIENT OF VARIATION

| Year | MA | IL | CA |
|---|---|---|---|
| A. *Unadjusted* | | | |
| 1970 | 0.22 | 0.29 | 0.21 |
| 1980 | 0.24 | 0.31 | 0.25 |
| 1990 | 0.29 | 0.33 | 0.28 |
| B. *Adjusted for Economy-Wide Income Inequality* | | | |
| 1970 | 0.13 | 0.16 | 0.14 |
| 1980 | 0.13 | 0.16 | 0.15 |
| 1990 | 0.14 | 0.16 | 0.15 |

between 1970 and 1990, while the lower part of the table shows that dividing by overall state-year income inequality eliminates this pattern. In other words, since 1970, there has not been increased sorting of households into districts based on income.

Table 4 uses regression to show how per-pupil valuation and per capita income explain per-pupil spending for Massachusetts and to see whether the relationships have changed over time. Estimates of $\beta_1$ and $\beta_2$ from the following regression are presented:

$$\mathrm{PPS}_{ijt} = \beta_0 + \beta_1 \mathrm{PPV}_{ijt} + \beta_2 \mathrm{PCI}_{ijt} + \beta_3 \mathrm{OLD}_{ijt} + \beta_4 \mathrm{HS}_{ijt} + \beta_5 \mathrm{GRAD}_{ijt} + \varepsilon_{ijt}$$

where PPS is per-pupil spending, PPV is per-pupil valuation, PCI is per capita income, OLD is the percentage of the population over age 65, HS is the percentage of high-school-aged children in the population, GRAD is the percentage of adults who are high-school graduates, and $\varepsilon$ is an error term; $i$ indexes districts, $j$ indexes states, and $t$ indexes time. The regression is run separately for each state and year.[3] No regressions were run for California

[3] Per capita income and the percentage of adults who are high-school graduates were estimated for 1900–1930 from regressions on indexes of occupational status and one-digit industry indicator variables. Varying the measure of income (median income or per-pupil income instead of per capita income) did not affect the regression results. The results were also relatively insensitive to the inclusion of available demographic variables other than the three shown.

TABLE 4—ESTIMATED COEFFICIENTS FROM REGRESSION OF PER-PUPIL SPENDING ON PER-PUPIL VALUATION (PPV), PER CAPITA INCOME (PCI), PERCENTAGE ELDERLY, PERCENTAGE SCHOOL-AGE, AND PERCENTAGE HIGH-SCHOOL GRADUATES, MASSACHUSETTS

| | Estimated coefficient | |
|---|---|---|
| Year | PPV | PCI |
| 1990 | 0.17 (0.06) | 0.35 (0.02) |
| 1910 | 0.16 (0.05) | 0.29 (0.02) |
| 1920 | 0.19 (0.06) | 0.33 (0.02) |
| 1930 | NA | NA |
| 1940 | 0.19 (0.05) | 0.32 (0.03) |
| 1950 | 0.21 (0.04) | 0.39 (0.02) |
| 1960 | NA | NA |
| 1970 | 0.22 (0.03) | 0.28 (0.03) |
| 1980 | 0.24 (0.02) | 0.20 (0.04) |
| 1990 | 0.33 (0.02) | 0.06 (0.04) |

*Note:* Standard errors are given in parentheses.

in 1980 and 1990 because the state effectively had only one fiscal district.

Space constraints prevent the inclusion of estimates of $\beta_3$, $\beta_4$, and $\beta_5$, but they may be summarized as follows. The percentage of the population over age 65 has a small positive, statistically significant (at the 5-percent level) effect on per-pupil spending in 1900 and 1910 (an additional 1 percent of the population being over 65 raises school spending by 0.5 percent). Estimates of this coefficient gradually reverse sign so that, by 1990, the percentage of the population over age 65 has a small *negative,* statistically significant effect on per-pupil spending (an additional 1 percent of the population being over age 65 lowers school spending by 0.7 percent). These results confirm those of Claudia Goldin and Lawrence Katz (1997) for the early part of the century and those of James Poterba (1997) for recent years. The percentage of households with school-age children has a consistently negative sign, and the percentage of adults who are high-school graduates has a positive, statistically significant effect on per-pupil spending until 1950 (but no statistically significant effect after that).

Table 4 demonstrates that per-pupil valuation and per capita income are powerful determinants of per-pupil spending. The equation explains the majority or a substantial minority of the variation in per-pupil spending among districts in each year. The $R^2$ coefficients for the Massachusetts regressions range between 0.31 (1940) and 0.58 (1950).

The first interesting pattern in Table 4 is that, from 1900 to 1970, per capita income is consistently a more powerful determinant of per-pupil spending than is per-pupil valuation. After 1970, the explanatory power of per capita income falls. Also, the estimated elasticity of spending with respect to per capita income falls from about 0.35 in 1900 to 0.06 in 1990 for Massachusetts and to 0.12 in 1990 for Illinois. The peak year for both explanatory power of per capita income and the elasticity of spending with respect to income is 1950 (for Massachusetts, the estimated coefficient is 0.39, and the associated $t$ statistic is 18.0).

There are two likely explanations for this result. The first is that over the past 20 years, grants to districts where low-income households reside (such as Title I, special-education aid, and bilingual-education aid) have grown so much that low per capita income now has an ambiguous effect on per-pupil spending. The second possible explanation is that per-pupil valuation is increasingly an indicator of the local demand for per-pupil spending.

This second explanation is related to the other interesting pattern in Table 4. The explanatory power of per-pupil valuation has grown significantly over the century, and the estimated elasticity of per-pupil spending with respect to per-pupil valuation has increased. The increased explanatory power of per-pupil valuation is more surprising than the changing explanatory power of per capita income because nearly all school-finance reforms since 1970 (foundation aid, power equalization, guaranteed tax revenue) have tried to eliminate the influence of local per-pupil valuation on per-pupil spending. The results suggest that per-pupil valuation is increasingly an indicator for those elements of taste and household income that determine demand for per-pupil spending.

## III. Conclusions

Per-pupil spending inequality has been relatively stable over the century, though there was a pronounced nadir of inequality in 1950. Most of the fluctuations in spending inequality were due to economy-wide changes in the inequality of household incomes. Spending inequality has not followed the pattern of inequality in per-pupil valuation, which has trended downward over the century.

Regressions of per-pupil spending on per-pupil valuation, per capita income, and demographic variables show that the relationship between spending and income grew stronger, in terms of both explanatory power and the elasticity of spending out of income, from 1900 to 1950 and then weakened. By 1990, there was no statistically significant relationship between local per capita income and per-pupil spending in the state of Massachusetts. The change was less dramatic for Illinois. The explanatory power of per-pupil valuation grew steadily from 1900 to 1990, despite school-finance equalization programs with redistribution formulas based (inversely) on per-pupil valuation. This is probably because per-pupil valuation has increasingly become an indicator for the locally preferred level of per-pupil spending.

Based on California's patterns of spending inequality, it would have been difficult to foresee that the state would have a school-finance crisis in the 1970's and ultimately abandon local school finance altogether. Of the three states, California had the lowest level and smallest fluctuations in inequality from 1900 to 1970. This evidence suggests that school-finance crises are not necessarily the result of systems breaking down, but may be due to rising expectations about the equality a state's school-finance system should be able to achieve.

The results have two implications for economics. First, the prevailing view of the relationship between income and spending may be too simplistic. Much of the empirical relationship between income and spending has already been eliminated. To reduce spending inequality, it would probably be more practical to focus on reducing income inequality than to redistribute an increasing share of existing

public-school revenues. Per-pupil valuation *does* matter for per-pupil spending, but probably not because of arbitrary differences in real property assets (which have apparently not had as much effect as claimed). Rather, per-pupil valuation is an increasingly good measure of local demand for school spending and should be viewed as such. Recent school-finance reforms treat per-pupil valuation as an asset impervious to the system of school finance. Future school-finance reforms should incorporate a more sophisticated understanding of valuation.

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