School Consolidation and Inequality

Christopher Berry
The University of Chicago
Harris School of Public Policy
crberry@uchicago.edu

May, 2006

Preliminary Draft

Comments appreciated.

Prepared for the Brookings Papers on Education Policy Conference: What Do We Know About the Effects of School Size and Class Size? May 22-23, 2006.

Introduction

One of the most remarkable yet least remarked upon accomplishments in American public education in the twentieth century is the success of the school consolidation movement. Between 1930 and 1970, 9 out of every 10 school districts were eliminated through consolidation. Nearly two-thirds of schools that existed as of 1930 were gone by 1970. The overall effect of these and related reforms was to transform the small, informal, community controlled schools of the 19th century into centralized, professionally run educational bureaucracies. The American public school system as we know it was born during this brief, dynamic period. While school consolidation represents arguably the most profound reform movement in 20th century education, almost nothing is known about its consequences for students.

In earlier work on the consolidation movement (Berry and West, 2005), Martin West and I found that students educated in systems with larger schools earned significantly lower wages as adults. Like many others who have studied the relationship between school attributes and student outcomes, we focused our attention on *average* outcomes. However, there is good reason to suspect that school consolidation influenced the *variation* in student outcomes as well. In particular, by dramatically cutting the number of schools and districts, consolidation reduced an important source of between-school and between-district variation in educational quality. At the same time, however, consolidation was motivated by a desire to increase instructional specialization, which could be achieved by substantially increasing the size of schools and districts. Thus, within-school and within-district variation in education quality may have risen as schools and districts became larger and instruction more specialized. This paper investigates the relationship between changes in school and district size and variation in student outcomes, as measured by adult wage inequality.

The paper is organized as follows. The next section provides background information on the consolidation movement and related trends in the organization of public education. Section 2 reviews related literatures about the effect of school and district size on student outcomes, and about the contribution of education to wage inequality. Section 3 describes the estimation strategy and data. Section 4 presents the results of the analysis, and section 5 concludes.

1. Background: The School Consolidation Movement

The movement for school consolidation must be seen as part of a larger trend toward the professionalization of education that began in the late nineteenth century.[1] To the "administrative progressives" of the time, the concentration of authority over schooling in the hands of professional educators was seen as a cure for both the corruption of city school systems and the parochialism of rural systems. Consolidation came first to urban areas, where one of the cornerstones of the progressive attack on rule by political machines was the formal organization of schooling under the leadership of professional superintendents. Reformers then turned their attention to rural areas, where they decried the inefficient, unprofessional and "backward" practices of small community schools. In their vision of a professionally run school, reformers drew their inspiration from the modern corporation, with its principles of "scientific" management by experts.

At the center of this reform movement was a push for larger schools. The leading education reformer of the early twentieth century, Ellwood P. Cubberley, pressed three

[1] The discussion in this paragraph is based on Tyack (1974).

primary arguments in favor of school consolidation.[2] First, in small schools, many of which had only one teacher, the ratio of administrators and school officials to teachers was unnecessarily high. Larger schools allowed for more efficient, centralized administration. Second, at a time when many small schools did not even divide children by grade level, consolidation held the promise of highly specialized instruction. Not only could teachers in large schools specialize by grade, but also by subject area. In addition, reformers sought to provide specialized training to students destined for different roles in the labor force. Third, a consolidated school could provide better facilities at lower cost. For instance, Cubberley's plan for a model elementary school building included, in addition to classrooms, a manual training room, a library, an assembly hall, a domestic science room, and a science laboratory (1922, 253). Supporting these facilities required concentration of students and resources. In sum, consolidated schools, in the view of Cubberley and other reformers, provided economies of scale in administration, instruction, and facilities.

The success of Cubberley and his progressive colleagues can be seen in the precipitous decline in the number of U.S. schools beginning in the 1920s, as shown in Figure 1.[3] After proliferating since the founding of the first colonies, the number of public schools reached a peak of 217,000 in 1920. The number of schools declined rapidly over the succeeding 50 years. The pace of decline slowed in the 1970s, and the number of schools reached a nadir in the late 1980s at around 83,000. Also notable over the period was a pronounced shift away from one-teacher schools. In the first year for

---

[2] This discussion draws especially from chapter 10 of Cubberley (1922).

[3] The *Biennial Survey of Education* was the federal government's first publication to systematically track statistics related to state and local education. The *Biennial Survey* began publication in 1869, changed titles to the *Digest of Education Statistics* in 1960, and continues publication under that name to this day. These two publications are the source of data for all the Figures presented in this paper.

which data on one-teacher schools are available, 1927, they composed 60 percent of all public schools. By 1970, one-teacher schools had all but died out; only about 400 remained as of 1999.

While schools were being consolidated, the number of pupils in attendance was on the rise. Average daily attendance (ADA) in public elementary and secondary schools roughly doubled from 1929 to 1969, rising from approximately 21 to 42 million.[4] The dwindling number of schools coupled with rising attendance led average school size to increase dramatically during the middle the twentieth century. Figure 2 shows the average size of schools over the period for which data are available. Over the period of rapid consolidation, 1930 to 1970, ADA per school increased from 87 to 440. In other words, the average school was five times larger in 1970 than in 1930. Schools witnessed their most rapid burst of growth in the years from 1950 to 1970, as increasing attendance rates, the baby boom, and institutional consolidation coincided.

The desire to consolidate schools was linked directly with the necessity of consolidating districts. It was the general opinion of Cubberley and other reformers of the day that one consolidated school should be created in place of five to seven existing schools, on average (Cubberley, 1922, 227). The average school district at the time, however, had only two schools, and most districts in rural areas operated only a single school. Thus, consolidating five to seven schools usually would require consolidating school districts as well. In Cubberley's view, therefore, the district system of school governance was "the real root of the matter." He contended that, "To have a fully

[4] Average daily attendance is a better indicator of size than is enrollment. Early in the century, there were often substantial discrepancies between the number of students nominally enrolled in schools and those who actually attended regularly. Today, the two are nearly identical. For a comparison of the average daily attendance and enrollment over time, see Heckman, Layne-Farrar, and Todd (1996).

organized school board in every little school district in a county, a board endowed by law with important financial and educational powers, is wholly unnecessary from any business or educational point of view, and is more likely to prevent progressive action than to secure it" (Cubberley, 1922, 186). A central aim of the consolidation movement, therefore, was to change the governance of education, placing authority at higher levels, such as township, county, or state governments.

For these reasons, the consolidation of districts ran apace with the consolidation of schools, as indicated in Figure 3. The informal nature of school districts early in the twentieth century is evidenced by the fact that many states did not even keep a count of the number of districts prior to 1930.[5] The 1931-32 edition of the *Biennial Survey of Education* was the first to report statistics of school districts in each state. As Figure 3 shows, the data soon revealed a picture of decline in the number of districts. The number of districts fell by half between 1931 and 1953, as over 60,000 districts were dissolved by consolidation. The number of districts declined by half again between 1953 and 1963, and roughly half again by 1973. The number of districts stabilized in the early 1970s and has not changed appreciably over the last 30 years. Coupled with rising attendance, ADA per school district increased from approximately 170 to 2,300 students between 1930 and 1970, an increase of fourteen times, as shown in Figure 4.

State governments took an active role in consolidation. Professional educators linked to state departments of education often spearheaded initiatives to consolidate local schools, as part of broader efforts to expand state control over public education. Although local resistance to consolidation was often fierce, state governments induced

[5] Although data on the number of school districts are not available prior to 1931, if districts followed a trajectory comparable to schools, we can infer that the number of districts was at its apex around that time.

consolidation through fiscal incentives or forced consolidation by legislatively redrawing district boundaries (Hooker and Mueller, 1970). Gradually, local control over education was weakened by the elimination of most locally elected school boards, and the authority of the remaining boards was eroded as state governments gradually extended their authority over previously locally controlled issues, such as accreditation, curriculum, and teacher certification (Strang, 1987). In short, as schools became larger school boards became more distant from local communities and lost authority relative to professional administrators and state government officials.

The increasing role of state governments in public education is demonstrated by the rapid centralization of school funding that occurred over the same period. As demonstrated in Figure 5, the state share of funding for public education grew considerably from about 1930 to 1950, and made a smaller jump again in the late 1970s. The local share of revenue, meanwhile, declined from more than 80 percent early in the century to less than half by the mid-1970s. For about the last 25 years, state and local governments have contributed nearly equal shares of public education funding. The federal share of education funding has risen noticeably from its starting point of next to nothing in 1920, but still remains at less than 10 percent.

My aim in this paper is to investigate the impact of institutional changes associated with the school consolidation movement on the variance of student outcomes, as measured by wages. Theoretically, the consolidation movement would appear to have had two, possibly countervailing, effects on the within-state variance in educational quality. On the one hand, by greatly reducing the number of independent districts and individual schools, consolidation should have increased the uniformity of education received within states. That is, by created ever larger districts and schools, consolidation should have reduced between-district and between-school variation in educational quality. On the other hand, one of the reformers' avowed motives for creating larger schools and districts was to facilitate the specialization of instruction within schools. Whereas a small one-room school provided essentially the same educational experience for every student, large consolidated schools could specialize instruction according to students' age, ability, interest, and career track. Thus, the consolidation movement presents a tradeoff between reduced between-school and between-district variation in education, and increased within-school and within-district variation. Although available data do not permit me to analyze these two components of variation separately, the remainder of the paper attempts to assess the net effect of consolidation on the variation in students' adult wages.

2. Related literature

I am not aware of any existing study of school consolidation and the variance of student outcomes. The topic, however, is at the intersection of two large related literatures, one on the effects of school quality on average student outcomes, the other on the relationship between educational attainment and wage inequality. The school quality literature is too vast and controversial to review in any detail here.[6] Rather, I will focus on a handful of studies dealing specifically with school and district size. The most closely related study is Berry and West (2005), who investigate the effects of changing school and district size associated with consolidation on average adult wages for white

[6] Hanushek (1998) provides a useful review of the literature. The contributors to Burtless (1996) demonstrate its controversies.

men born between 1920 and 1949. Using several different identification strategies, the authors find that students educated in systems with larger schools earn significantly lower wages as adults. They focus on mean wages and do not investigate the variance in outcomes.

The literature on school and district size for more recent cohorts is reviewed by Andrews, Duncombe and Yinger (2002). Of the seven studies of school size and student performance reviewed by these authors, only one, Kenny (1982), found increasing returns to scale.[7] The remaining six studies found decreasing returns to scale. Four of these studies also identified constant returns to scale over at least some range of the data, suggesting that returns to scale in school size are non-linear (Andrews, Duncombe, and Yinger, 2002). Summers and Wolf (1977) find that African American students are particularly harmed by large school size, while Lee and Smith (1997) find that students of low socio-economic status do particularly poorly in large schools. Both of these results would imply a positive relationship between school size and the variation in student outcomes, although this relationship is not the focus of either paper. Although the reasons for the superior performance of small schools have not been definitively identified, explanations have focused on non-academic factors, such greater sense of community belonging among students, closer interaction with adults, and greater parental involvement (e.g., Cotton, 1996).

The empirical literature on the effects of *district* size on student outcomes is smaller and less consistent in its findings. Walberg and Fowler (1987) and Ferguson (1991) find a negative relationship between student achievement and district size,

[7] Usefully, Andrews, Duncombe, and Yinger (2002) restrict their survey to studies that meet minimum standards of methodological rigor.

controlling for student and teacher characteristics, in New Jersey and Texas, respectively. On the other hand, Sebold and Dato (1981) find increasing returns to district size for California high schools, while Ferguson and Ladd (1996) find increasing returns to district size for elementary schools in Alabama. Unfortunately, as each of these studies focuses on a different state, it is difficult to identify the reasons for the discrepancies in their conclusions. Hoxby (2000) takes a different approach, focusing on competition among districts rather than size per se. In a study of metropolitan areas nationwide, Hoxby (2000) finds a negative relationship between student achievement and the concentration of enrollment in a small number of school districts.

A second branch of related literature examines the growth in wage inequality beginning in the 1970s. This extensive literature is reviewed by Levy and Murnane (1992) and Katz and Autor (1999). A central theme is that wage differentials by education have increased dramatically, in particular the college-high school wage premium, and represent an important component of overall increases in wage inequality (e.g., Katz and Murphy, 1992). At the same time, however, residual wage inequality—that is, wage dispersion within groups of workers with the same level of education and experience—has also increased substantially, and accounts for a large part of the total increase in wage inequality (e.g., Juhn, Murphy, and Pierce, 1992). While Katz and Autor (1999, pp. 1497-98) suggest variation in school quality as a potential explanation for growing wage inequality, I am not aware of any study to test this proposition directly. Thus, while education plays a prominent role in the inequality literature, no one has yet provided evidence of a connection between school quality and wage inequality, much less a relationship between the school consolidation movement and inequality.

3. Empirical Strategy and Data

The basic question of this paper is whether there is a relationship between the institutional changes associated with the school consolidation movement and the variance of student outcomes. Direct measures of academic performance, such as standardized test scores, are not available across states for the period under investigation. Instead, I rely on students' adult wages as my measure of performance. To the extent that the labor market rewards educational quality, variation in wages for students educated in school systems with different institutional characteristics, all else equal, should reflect variation in school quality associated with those characteristics. By the same token, the inequality in wages for students educated in different school systems should reflect the unevenness of educational quality within those system, holding other factors constant.

I use data from the PUMS A Sample of the 1980 census. Cases are restricted to white men born in the 48 mainland states between 1920 and 1949, which produces a sample of 994,000 individuals.[8] The analysis proceeds in two stages. In the first, I divide the sample into state-of-birth by year-of-birth cells. With 48 states by 30 years of birth, I have a total of 1,440 cells. The average cell size is 688 observations, the median is 485. The largest cell has 5,100 observations, the smallest 17; 90 percent of cells have at least 110 observations.[9] Within each cell, I compute four measures of inequality: the standard deviation of log weekly wages, the difference between the 90th and the 10th percentile of the log weekly wage distribution, the difference between the 90th and the 50th percentile,

[8] The focus on white men is necessary because of the rapid and geographically uneven changes in the labor market opportunities for women and blacks during the period. Additional details on case selection are provided in the data appendix.

[9] In the analyses presented below, I weight cells by sample size. Eliminating the cells with fewer than 100 observations does not importantly change the results.

and the difference between the 50th and the 10th percentile. The first two indices reflect overall variation in wages, the 90-50 differential reflects variation at the upper end of the distribution, while the 50-10 differential reflects variation and the lower end (Katz and Autor, 1999).

The average value of each of these inequality measures across states is presented by year-of-birth in Table 1. Clearly, wage inequality is steadily increasing with age, as those born most recently have the lowest level of wage inequality across all four measures. Certainly much this pattern is explained by growing wage dispersion with age and experience. The second stage analysis seeks to determine whether any of the difference in average inequality across birth-years can be associated with differences in school characteristics related to consolidation. In other words, is any of the reduction in wage variation for men educated more recently attributable to the fact that they were generally educated in larger schools, within larger districts, with more centralized funding?

In the second stage, these indices of inequality are regressed against average school size, average district size, and the state share of funding for education. All of the school attributes are derived from the *Biennial Survey of Education*. For each cell, the quality measures are averaged over the years in which someone born in a given year would have been in school, assuming a starting school age of 6 and allowing for a maximum of 12 years in public school. So, for instance, the cell of individuals born in Ohio in 1930 would be matched with the average school characteristics in Ohio from

1936 to 1947.[10] Thus the second stage models also include state-of-birth and year-of-birth fixed effects. Identification in the second stage models is thus based on variation within states over time in the deviation from the national level of inequality for a given year of birth. Cells are weighted by sample size, and standard errors are clustered by state of birth.

Using this method, differences in wage inequality associated with school quality could arise for two reasons. First, a given attribute of a state's school system might affect the variation in educational attainment. Second, a given attribute might affect the variation in the return to a year of education. Either of these effects would influence the within-cell variation in observed wages. In an effort to disentangle effects on educational attainment from effects on the return to education, I present an additional analysis based on state-of-birth by educational attainment cells. Specifically, I divide the sample into four educational classes: those with less than 12 years of education, those with exactly 12 years, those with 13-15 years, and those with 16 or more years of education. In order to prevent cells from becoming too small, I use 10-year birth cohorts rather than individual year-of-birth cells; i.e., cohort one born 1920-29, cohort two born 1930-39, and cohort three born 1940-49. This approach produces 576 cohort by state-of-birth by education class cells, with an average size of 1,719 and median size of 1,055. Finding a relationship between school attributes and within-education class wage inequality would suggest that the effect of school quality on wage inequality operates at least partly through the return to education.

[10] It is possible to match each individual to the specific years he was in school, using information on year of birth and years of education. However, for a cell of individuals born in the same year, this conflates educational quality with years of education. This issue will be discussed further below.

The average value of each of these inequality measures across states is presented by education class and cohort-of-birth in Table 2. Interestingly, there is no apparent difference in inequality between the older and younger cohorts for the least educated group of workers. Again, the second stage of analysis presented below seeks to ascertain whether any of the within-education group differences in inequality across cohorts can be attributed to differences in school characteristics associated with consolidation.

As discussed above, school consolidation must be seen as part of a broader movement of educational reform. Over the same period, for example, the school term grew longer and class sizes grew smaller. In a related paper, Card and Krueger (1992) argue that these school quality measures exert a positive effect on returns to education for the same cohort of men observed in the 1980 PUMS. Although the authors do not investigate the effects these school quality measures on wage inequality, I will include class size and term length in the models estimated below to eliminate this potential source of omitted variable bias. State average measures of term length and the ADA-based ratio of pupils to teachers over time are derived from the *Biennial Survey of Education*.[11] In addition, to control for the state's resources, I include state per capita income and the percent of the state's population that is rural.[12] The annual income data are from the BEA's Regional Economic Information System, and the percent rural is from the decennial Census, with linear interpolation for intervening years. Each of the control variables is averaged over the years an individual with a given year of birth could have been in school, as described above.

---

[11] I am grateful to Petra Todd for providing me with the term length and pupil-teacher data.

[12] I would much prefer to have data on the within-state *variation* in resources by year of birth, such as lagged state-level wage inequality. Unfortunately, the data necessary to make consistent comparisons of wage structure are not available prior to 1940 (Katz and Autor, 1999), which leaves out much of the period under consideration here. Lack of controls for inequality at the time of birth is a significant limitation, and I hope to find an alternative approach for a future version of the paper.

Summary statistics for the state-of-birth by year-of-birth cells and for the state-of-birth by cohort-of-birth cells are presented in Table 3.

4. Results

Table 4 presents models of the standard deviation of the log weekly wage within state-of-birth by year-of-birth cells. The quality attributes are introduced individually and then jointly, with percent rural, per capita income, and state-of-birth and year-of-birth effects used as controls in all the models. Of the five school quality variables examined, only term length demonstrates a significant relationship with wage inequality. The results also indicates that individuals from cells with a larger rural population have greater variation in adult wage inequality. However, the relationship between ruralness and wage inequality is no longer significant when term length is included. Unsurprisingly, there is a significant correlation between term length and percent rural across cells of -0.61, an indication that school terms were historically shorter in years and states with more rural populations. It appears from equations (5) and (6) of Table 4 that it is term length, rather than ruralness per se, that is related to wage inequality. One interpretation of this result is that increasing average term lengths result from a reduction in the differential between rural and urban terms, with a resulting decrease in the associated adult wage differential. Substantively, the effect of term length on inequality is modest, with the coefficient in model (6) indicating that a one standard deviation increase in term length is associated with a decrease of about one-eighth of a standard deviation in wage inequality.

Income per capita also becomes significant statistically when term length is controlled for in models (5) and (6). Individuals from cells with higher income during their school years demonstrate lower wage inequality as adults. The effect of income is substantial, with the coefficient in equation (6) indicating that a one standard deviation increase in per capita income is associated with nearly a one-half standard deviation decline in adult wage inequality. In addition, class size is marginally significant in the omnibus model (6), with a negative coefficient suggesting that smaller classes are associated with greater wage inequality. The negative relationship between class size and inequality may result from increased sorting of students by ability in school systems with smaller classes, although I have no direct evidence that this is the case for period under consideration here. Finally, it is worth noting that the variables included in the model explain relatively little of the total variation in wage inequality across cells. A model including only state-of-birth and year-if-birth dummies yields an R-squared of 0.631. Meanwhile, model (6), which includes all quality variables and controls, yields an R-squared of 0.642.

Table 5 presents models of three additional measures of inequality based on differentials between percentiles of the within-cell log wage distribution. The 90-10 differential captures overall wage inequality, and in this model term length, income, and class size all demonstrate negative effects, consistent with the results from Table 4. Term length appears to exert its effect primarily at the lower end of the wage distribution, as its coefficient for the 50-10 differential is larger and highly significant, whereas for the 90-50 differential it is not. In other words, increasing term lengths were associated with reduced variation at the low end of the wage distribution, perhaps because term length increases were concentrated in rural areas. Income per capita, meanwhile, appears to have had roughly equivalent effects throughout the wage distribution. Interestingly, the percent rural variable produces a significant, positive coefficient in the 50-10 equation, and a significant, negative coefficient in the 90-50 equation. Apparently, individuals from cells with larger rural populations experienced greater wage variation at the low end of the distribution, but less variation at the top end, as adults.

Overall, the results of Tables 4 and 5 do not provide much evidence of a connection between the school consolidation movement and variation in student outcomes, as measured by adult wages. Of the school quality variables examined, only term length exhibits a strongly significant relationship with wage inequality, with class size demonstrating a marginally significant association. Neither term length nor class size is necessarily related to consolidation, although changes in them tended to occur contemporaneous with consolidation, as explained above.

The models in Tables 4 and 5 can be thought of as reduced from models, in that they subsume effects operating through both changes in educational attainment and changes in the return to education. In other words, increasing term length may reduce wage variation by either reducing the variation in completed years of education or by reducing the variation in the return to a year of education. In order to untangle these two effects, the next series of models examine wage variation within cells defined by educational attainment. Four education categories are examined: less than 12 years of education, exactly 12 years of education, 13 to 15 years of education, and 16 or more years of education. Within each education category, I compute wage variation within state-of-birth by cohort cells, where cohorts are defined by those born from 1920 to 1929, 1930 to 1939, and 1940 to 1949. For each educational group, therefore, there are 144 cells representing three cohorts by 48 states of birth. Tables 6 through 9 present models of each of the four measures of log wage inequality for each educational class.

Models of wage inequality for men with less than a high school degree are presented in Table 6. Term length again shows a negative relationship with wage inequality, and is significant in all of the models except the one for the 90-50 wage differential. Even in the lowest education group, then, the effects of increasing term length are concentrated at the bottom of the wage distribution. School size is significant for the first time and also demonstrates a negative relationship with wage inequality. In other words, men of low education from states and cohorts with larger schools experienced diminished wage inequality. For example, a one standard deviation increase in school size is associated with a one-half standard deviation reduction in the 90-10 log wage differential. District size, however, appears to work in the operate direction, as the coefficient indicates that a one standard deviation increase in district size is associated with a one-half standard deviation *increase* in the 90-10 wage differential among this category of men with less than a high school degree.

For those with a high school degree and those with some college, presented in Table 7 and 8 respectively, term length consistently demonstrates a significant, negative relationship with wage inequality, with disproportionate effects for the 50-10 wage differential. School size and district size, while retaining, respectively, their negative and positive signs, do not attain statistical significance at conventional levels for any of the models in Tables 7 and 8. The consolidation-related variables thus demonstrate no relationship with educational inequality for the modal educational group, high school graduates, or for those with some college.

Results for men with sixteen or more years of education are presented in Table 9. Term length proves to be negative and significant in every model, consistent with findings for the other education groups. Interestingly, school size shows a negative effect for the 50-10 differential but a positive effect for the 90-50 differential, although only the latter is significant. The positive relationship between school size and the 90-50 differential is opposite of the negative relationship observed for the less than high school education group in Table 6. Moreover, the estimated effect is substantial; the coefficient suggests that a one standard deviation increase in school size is associated with nearly a two-third standard deviation increase in the 90-50 differential for college graduates. Finally, district size registers a significant positive relationship with the 50-10 wage differential, although it does not attain statistical significance in any of the other models in Table 9.

5. Discussion

Overall, the analysis presented above provides little evidence that the school consolidation movement had important effects on the variance of outcomes, as measured by wages, for most students. Among the lowest educational attainment group, being educated in a state and cohort with larger schools is associated with lower inequality in adult wages. This finding may indicate that state-cohort cells with larger schools provided a more uniform standard of education for low-achieving students, possibly by reducing the variation in school quality in rural areas, where one-room schools had been the norm prior to consolidation. At the same time, school size is shown to have a positive relationship with wage inequality for college graduates, although only for the 90-50 log wage differential. One interpretation of this finding is that larger schools provide more specialized instructional opportunities, which are especially relevant for college-bound students. However, I am hesitant to make much of the latter finding, both because it is counterintuitive and because school size is significant in only one of the four models for college graduates.

The positive association between district size and wage inequality among those who did not complete high school is also a puzzle. To the extent that within-district quality is more uniform than between-district quality, district consolidation would be expected to reduce variation in student outcomes. However, it is possible that larger districts systematically provide different opportunities for students with lower educational attainment. Additional research using contemporary data may shed light on this question.

Notably, the state government's share of education funding registers no significant effect at conventional levels in any of the estimated models. By this account, greater centralization of spending has not historically produced the equalizing effects sought by many of today's school finance reformers. Although not an indicator of consolidation per se, class size shows a negative relationship with inequality, which is significant at the 10 percent level in several models. It is possible that smaller classes provide greater opportunities for sorting students by ability or background, which ultimately exacerbates variation in achievement.

Of all the variables examined, term length evinces the most robust relationship with wage inequality. For the total sample of state- and year-of-birth cells, and for each of the education groups, term length is negatively associated with wage inequality. Moreover, for the total sample and each of the subgroups, term length exhibits its largest effect on inequality at the lower end of the wage distribution, as indicated by the 50-10 wage differential. That term length produces an effect for every category of educational attainment suggests that its overall impact on wage inequality must arise at least partly through reducing the variation in returns to education. Although, I do not have data on within-state variation in term length, it is likely that increases in average term length were achieved by increasing school terms in rural districts, which historically lagged urban districts in the length of the school year. It is also plausible that increasing terms for rural schools produced more even educational quality between rural and urban districts, which was later reflected in reduced variation in adult wages.

It is tempting to conclude that increasing term length is a proven strategy for reducing inequality that ought to be emulated in current policy reforms. Indeed, there are those who champion "year-round" or "extended-time" schooling even today (e.g., Gandara and Fish, 1994).[13] I am cautious about making inferences for contemporary policy reforms based on the analysis presented here because my entire sample is composed of men born before 1950. Much has changed. Nevertheless, school term extension may be a promising reform, and on that is relatively easy to implement. In addition, changes in school terms are amenable to randomized trials, which would generate more compelling evidence of a causal relationship than the design used in this

[13] Also see, for instance, the National Association for Year-Round Education, and their associated website (www.nayre.org) and publications.

paper. Finally, while reducing inequality is a laudable policy goal, reforms should be based on expectations about effects on average outcomes, not inequality alone.

Data Appendix

1980 Census Data

The sample is constructed from the 5% Public Use A file, which is a self-weighting sample of the U.S. population. I limit my analysis to white men born between 1920 and 1949 in the 48 mainland states, with years of birth estimated from information on birth quarter and age. Cases with imputed data for age, race, sex, education, weeks worked, or earnings are dropped. Individuals who reported no weeks of work, annual wage and salary income of less than $101, or average weekly wage and salary income of less than $36 or more than $2,500 were also excluded.

School Characteristics

Data on average daily attendance, the number of public schools, the number of school districts, and the state share of funding for public education were gathered from various issues of the *Biennial Survey of Education* and, after 1960, the *Digest of Education Statistics*. Data on term length, and the ADA-based pupil teacher ratio are derived from the same sources, and were provided to me by Petra Todd, whose assistance I gratefully acknowledge. Because data from the *Biennial Survey* are available only every two years, I code each estimate to the odd year of the issue and linearly interpolated values for the even year.[14]

Other Variables

Annual state per capita income beginning in 1929 is from the *State Personal Income Estimates* of the Bureau of Economic Analysis. I used the consumer price index to convert all of the estimates into 1967 dollars.

The percent of the population classified as rural was taken from the 1920, 1930, 1940, 1950, and 1960 U.S. censuses. Values for intervening years were linearly interpolated.

Year-of-Birth Aggregates

Each year of birth is assigned the average of the school characteristics, per capita income, and percent rural over the period people born in that year would have attended school, assuming a maximum 12 years of schooling.[15] When a variable is not available for a given year—for instance, per capita income for 1926-1928, values are averaged over the years for which data are available.

---

[14] For instance, the values reported in the 1931-32 and 1933-34 editions are assigned to 1931 and 1933, respectively. The value for 1932 is then computed as the average of these values.

[15] For instance, a high school graduate born in 1920 would have entered school in 1926 and graduated in 1937. So school characteristics were averaged over 1926-1937 for individuals born in 1920.

References

Andrews, Mathew, William Duncombe, and John Yinger. 2002. "Revisiting Economies of Size in American Education: Are We Any Closer to a Consensus?" *Economics of Education Review* 21, 245-262.

Berry, Christopher, and Martin West. 2005. "Growing Pains: The School Consolidation Movement and Student Outcomes." Working Paper, Harris School of Public Policy, The University of Chicago.

Card, David, and Alan Krueger. 1992. "Does School Quality Matter: Returns to Education and the Characteristics of Public Schools in the United States." *Journal of Political Economy* 100, 1-40.

Cotton, Kathleen. 1996. "School Size, School Climate, and Student Performance." School Improvement Research Series, Office of Educational Research and Improvement.

Cubberley, Ellwood P. 1922. *A Brief History of Education*. Boston: Houghton-Mifflin.

Ferguson, R. F., and Ladd, H. F. 1996. Additional Evidence on How and Why Money Matters: A Production Function Analysis of Alabama Schools. In H. F. Ladd, *Holding Schools Accountable: Performance-Based Reform in Education*.

Gandara, Patricia, and Judy Fish. 1994. "Year-Round Schooling as an Avenue to Major Structural Reform." *Educational Evaluation and Policy Analysis*, Vol. 16, No. 1. (Spring), pp. 67-85.

Heckman, James, Anne Layne-Farrar, and Petra Todd. 1996. "Human Capital Pricing Equations with an Application to Estimating the Effect of School Quality on Earnings," *Review of Economics and Statistics* 78, 562-610.

Hooker, Clifford, and Van Mueller. 1970. *The Relationship of School District Reorganization to State Aid Distribution Systems*. National Education Finance Project Special Study No. 11.

Hoxby, Caroline. 2000. "Does Competition among Public Schools Benefit Students and Taxpayers?" *American Economic Review* 90, 1209-1238.

Juhn, Chinhui, Kevin M. Murphy, and Brooks Pierce, 1993. "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy* 101, June, 410-42.

Katz, Lawrence, and David Autor. 1999. “Changes in the Wage Structure and Earnings Inequality.” In O. Ashenfelter and D. Card (eds.) *Handbook of Labor Economics*, volume 3A, Amsterdam: Elsevier Science.

Katz, Lawrence, and Kevin Murphy. 1992. “Changes in Relative Wages, 1963-1987: Supply and Demand Factors,” *Quarterly Journal of Economics* 107*,* January, 35-78.

Strang, David. 1987. “The Administrative Transformation of American Education: School District Consolidation, 1938-1980.” *Administrative Science Quarterly* 32, 352-366.

Kenny, Lawrence. 1982. Economies of Scale in Schooling. *Economics of Education Review* 2, 1–24.

Lee, V. E., and J. B. Smith 1997. High School Size: Which Works Best and for Whom? *Educational Evaluation and Policy Analysis* 19, 205–227.

Levy, Frank, and Richard J. Murnane. 1992. “U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations.” *Journal of Economic Literature* 30(3), September, 1333-81

Sebold, F. D., and W. Dato. 1981. School Funding and Student Achievement: An Empirical Analysis. *Public Finance Quarterly* 9, 91–105.

Summers, Anita A., and Barbara L. Wolfe. 1977. Do Schools Make a Difference? *American Economic Review* 67, 639–652.

Tyack, David. 1974. *The One Best System: A History of American Urban Education*. Cambridge, MA: Harvard University Press.

Walberg, Herbert. J., and William J. Fowler. 1987. Expenditure and Size Efficiencies of public School Districts. *Educational Researcher* 16, 5–13.

Figure 1

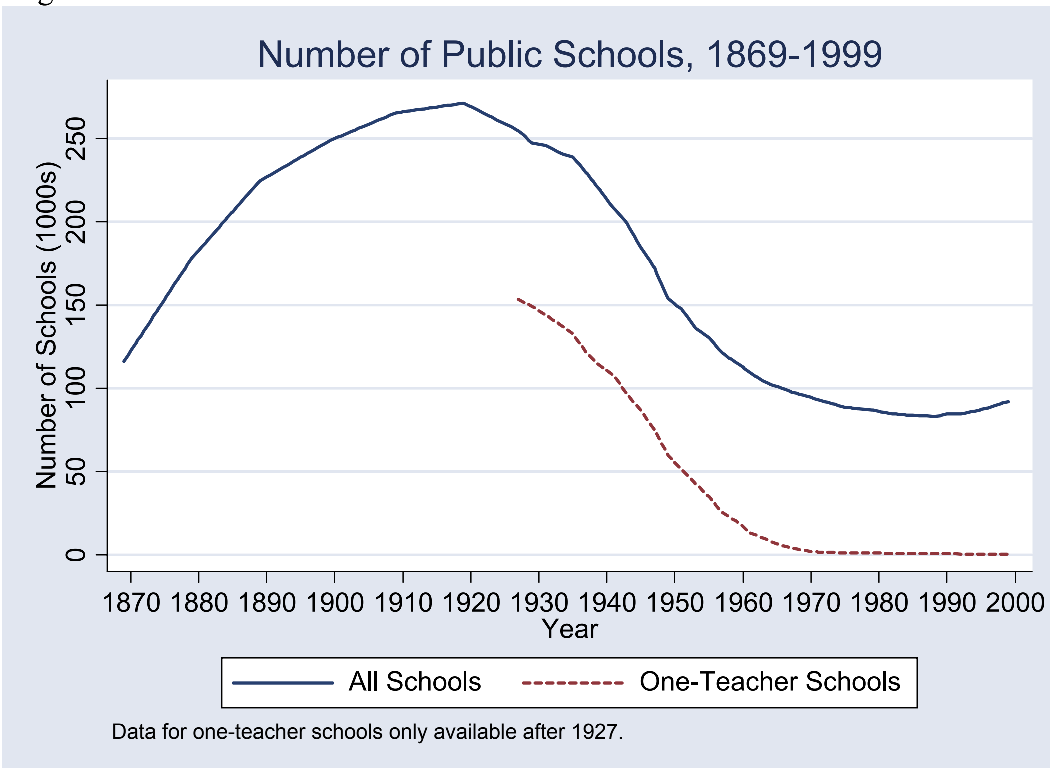


Figure 2

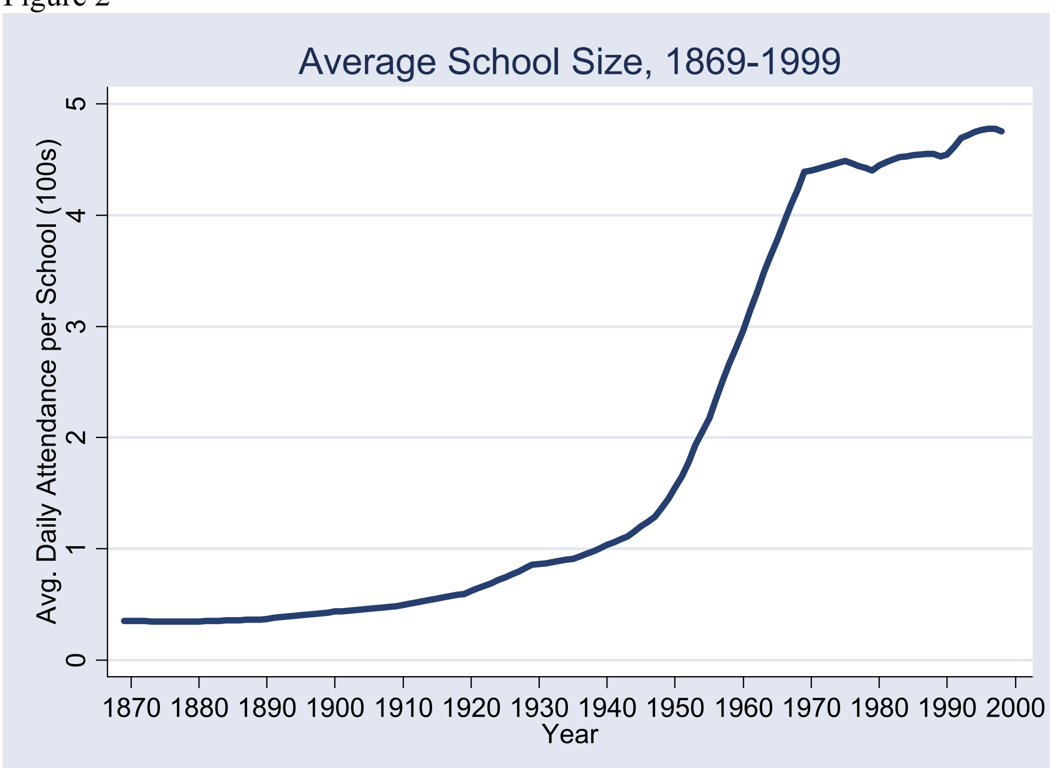


Figure 3

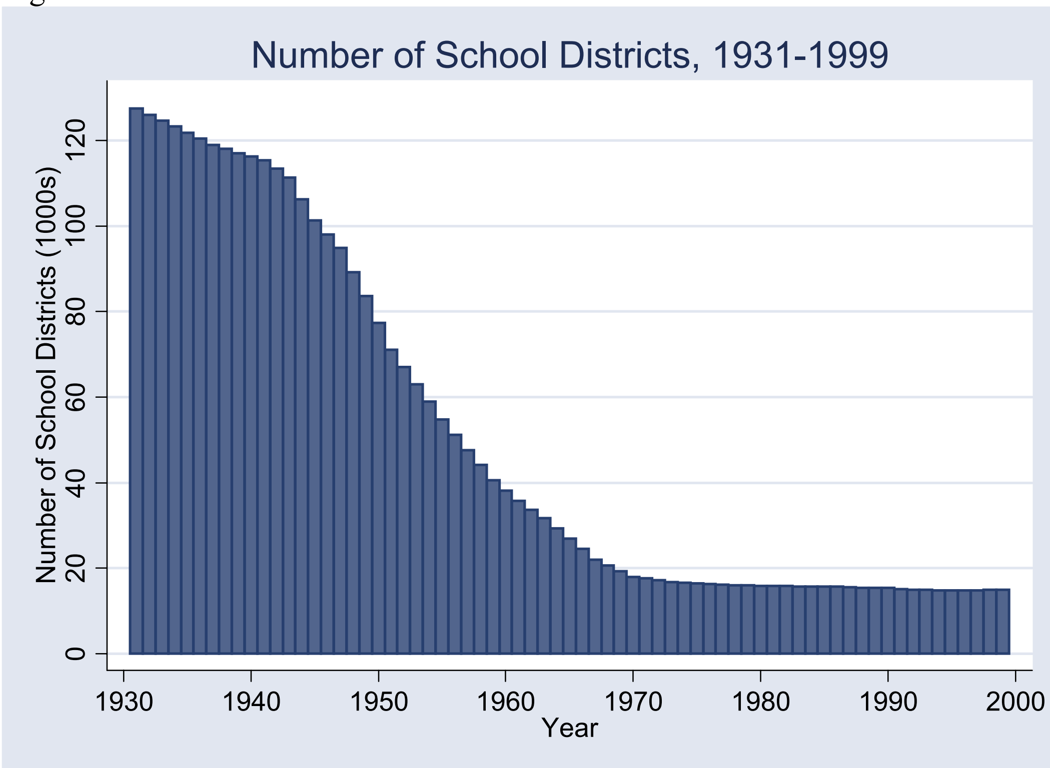


Figure 4

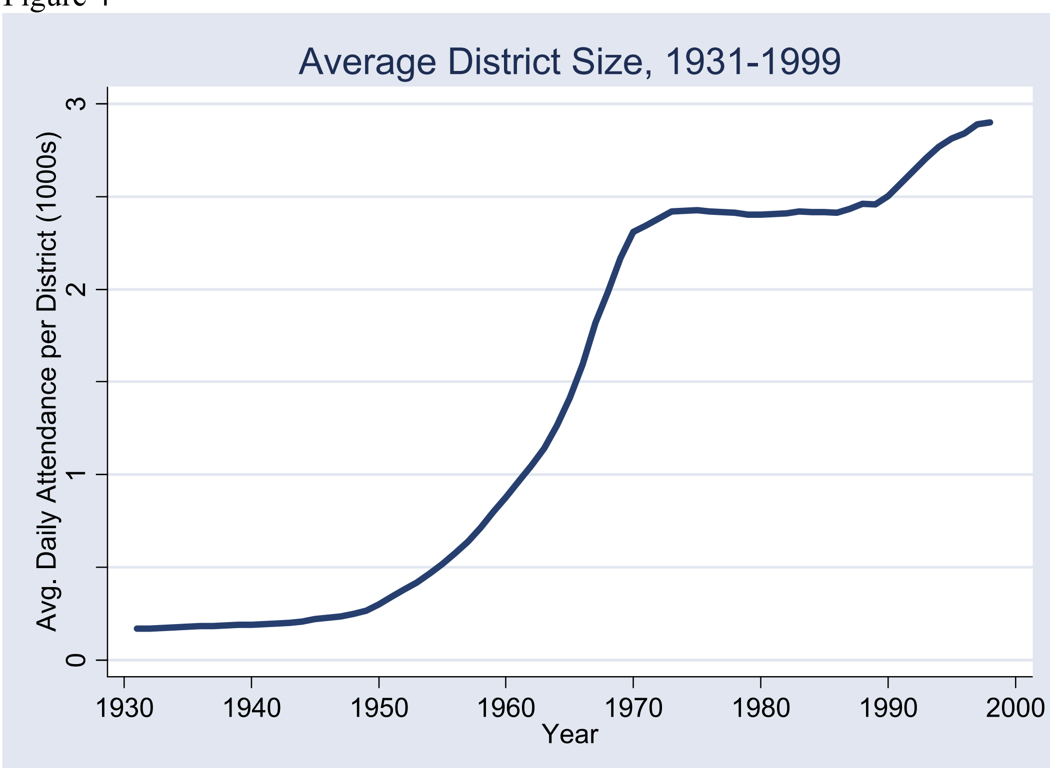
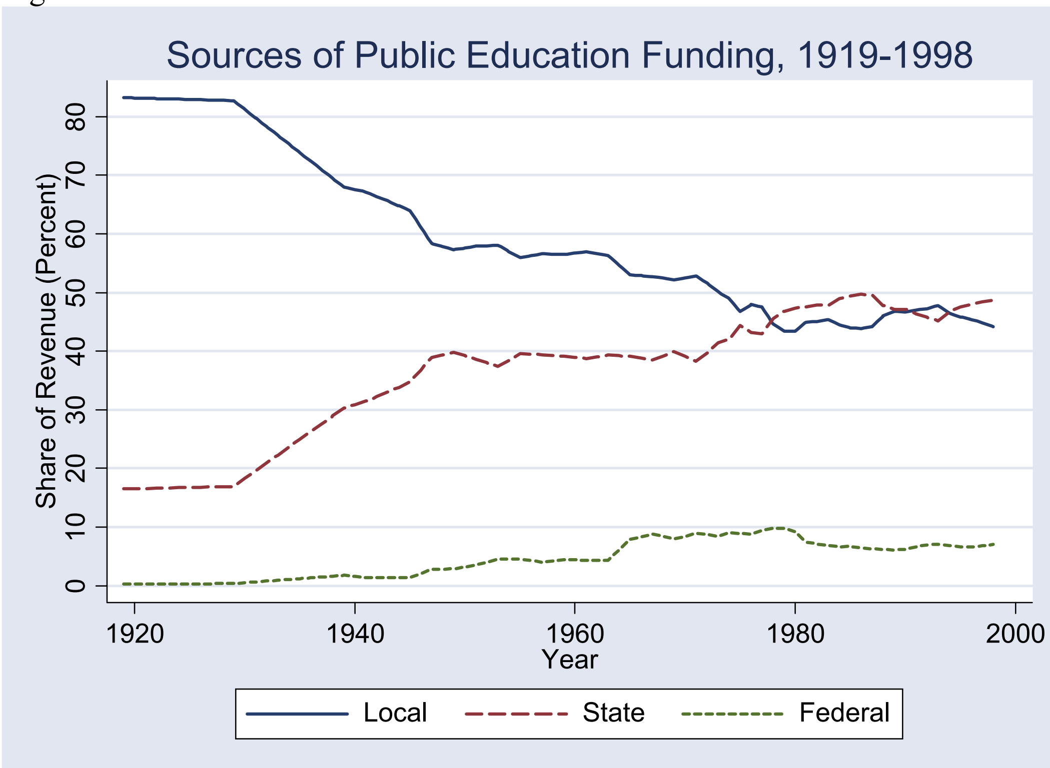


Figure 5



Sources of Public Education Funding, 1919-1998
Share of Revenue (Percent)
0
10
20
30
40
50
60
70
80
1920
1940
1960
1980
2000
Year
Local
State
Federal

Table 1: Average Within-State Wage Inequality by Year of Birth

Year of birth	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
1920	0.587	1.373	0.635	0.739
1921	0.577	1.355	0.629	0.726
1922	0.573	1.333	0.622	0.711
1923	0.576	1.342	0.625	0.717
1924	0.563	1.319	0.625	0.694
1925	0.566	1.311	0.603	0.708
1926	0.565	1.308	0.606	0.702
1927	0.565	1.321	0.614	0.706
1928	0.556	1.297	0.609	0.689
1929	0.557	1.296	0.604	0.692
1930	0.551	1.277	0.592	0.685
1931	0.543	1.263	0.584	0.679
1932	0.549	1.274	0.587	0.687
1933	0.545	1.260	0.588	0.672
1934	0.543	1.258	0.587	0.671
1935	0.546	1.263	0.580	0.682
1936	0.539	1.234	0.567	0.667
1937	0.532	1.215	0.563	0.652
1938	0.530	1.218	0.567	0.651
1939	0.530	1.209	0.551	0.658
1940	0.529	1.206	0.556	0.650
1941	0.518	1.185	0.542	0.643
1942	0.521	1.177	0.535	0.642
1943	0.515	1.168	0.524	0.644
1944	0.516	1.168	0.511	0.657
1945	0.505	1.142	0.496	0.646
1946	0.505	1.138	0.484	0.654
1947	0.499	1.129	0.481	0.647
1948	0.495	1.119	0.481	0.639
1949	0.494	1.122	0.478	0.644
Total	0.534	1.226	0.556	0.670

Observations represent state-of-birth by year-of-birth cells for white men born in the 48 mainland states between 1920 and 1949. Each row provides the average of the 48 state-level inequality measures, weighted by sample size. Inequality measures are based on log weekly wages. Data for are from the 1980 PUMS.

Table 2: Average Within-State Wage Inequality by Education Class and Cohort

Years of Education/ Birth cohort	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
A. Less than 12 years				
1920-29	0.525	1.199	0.513	0.686
1930-39	0.518	1.204	0.508	0.696
1940-49	0.528	1.251	0.537	0.713
Total	0.524	1.214	0.518	0.696
B. Exactly 12 years				
1920-29	0.504	1.117	0.470	0.647
1930-39	0.471	1.034	0.442	0.593
1940-49	0.463	1.036	0.437	0.600
Total	0.476	1.057	0.447	0.610
C. 13 to 15 years				
1920-29	0.550	1.251	0.574	0.677
1930-39	0.507	1.142	0.516	0.626
1940-49	0.488	1.088	0.465	0.623
Total	0.506	1.137	0.502	0.635
D. 16 or more years				
1920-29	0.580	1.370	0.665	0.705
1930-39	0.538	1.229	0.617	0.612
1940-49	0.524	1.173	0.553	0.619
Total	0.540	1.230	0.594	0.635

Observations represent state-of-birth by cohort-of-birth by education group cells for white men born in the 48 mainland states between 1920 and 1949. Each row provides the average of the 48 state-level inequality measures, weighted by sample size. Inequality measures are based on log weekly wages. Data for are from the 1980 PUMS.

Table 3: Summary Statistics

Variable	Mean	Median	St. dev.	Minimum	Maximum
A. State by year of birth data					
SD of log wages x 100	53.40	53.07	3.92	39.96	87.97
90-10 wage differential	1.23	1.21	0.12	0.71	2.38
90-50 wage differential	0.56	0.55	0.07	0.23	1.21
50-10 wage differential	0.67	0.66	0.07	0.39	1.66
Average ADA per school*	211.37	189.05	120.33	25.51	562.02
Average ADA per district*	1,626.18	694.32	2,500.85	31.91	23,721.21
State share of education funding	0.35	0.36	0.16	0.01	0.91
Average ADA per teacher	24.65	24.88	2.79	14.40	32.37
Average term length	177.12	178.29	6.57	135.38	187.29
Percent rural population	0.38	0.33	0.18	0.08	0.83
Income per capita (1967 dollars)**	1,981.71	2,016.20	634.95	425.25	3,326.11
B. State by cohort of birth data					
SD of log wages x 100	53.71	53.55	3.10	47.98	61.91
90-10 wage differential	1.24	1.23	0.10	1.04	1.48
90-50 wage differential	0.56	0.55	0.06	0.46	0.69
50-10 wage differential	0.68	0.67	0.05	0.57	0.85
Average ADA per school*	211.37	178.97	116.85	25.86	512.50
Average ADA per district*	1,626.18	722.71	2,483.15	32.79	19,730.08
State share of education funding	35.36	35.19	16.27	1.12	90.70
Average ADA per teacher	24.65	24.89	2.77	14.60	31.76
Average term length	177.12	178.61	6.43	138.86	186.91
Percent rural population	0.38	0.33	0.18	0.08	0.81
Income per capita (1967 dollars)**	1,981.71	2,002.74	617.34	537.94	3,098.74

Cells are weighted by sample size. *In the analyses below, school and district size are expressed as the natural log of ADA in thousands. **In the analyses below, per capita income is expressed in thousands of constant 1967 dollars. Data sources are described in the appendix.

Table 4: Standard Deviation of Log Wage, State x Birth-Year Cells

	(1)	(2)	(3)	(4)	(5)	(6)
School size	0.0092					-0.2345
	(0.5556)					(0.7598)
District size		0.2651				0.4009
		(0.2220)				(0.2795)
State share of funding			-1.4654			-0.0625
			(2.5752)			(2.3894)
Pupil-teacher ratio				-0.1401		-0.1837*
				(0.1129)		(0.1067)
Term length					-0.064***	-0.072***
					(0.022)	(0.023)
Percent rural	6.892***	7.198***	6.952***	5.808***	2.618	0.858
	(2.329)	(2.111)	(2.290)	(2.182)	(2.603)	(2.597)
Income per capita	-1.5508	-1.7529	-1.6520	-1.4167	-2.8420*	-3.0325**
	(1.4760)	(1.3610)	(1.3869)	(1.3744)	(1.4889)	(1.4071)
N	1440	1440	1440	1440	1440	1440
R^2	0.64	0.64	0.64	0.64	0.64	0.64

Observations represent state-of-birth by year-of-birth cells for white men born in the 48 mainland states between 1920 and 1949. The dependent variable is the within-cell standard deviation of log weekly wages in 1979 multiplied by 100. Observations are weighted by sample size. All models include state-of-birth and year-of-birth fixed effects. Robust standard errors, with clustering on state-of-birth, are reported in parentheses. The independent variables are state-of-birth specific averages over the years in which an individual born in a given year could have been in school, assuming a school starting age of 6 and a maximum of 12 years of schooling. School size and district size are measured as the log of average daily attendance in thousands. Income per capita is measured in thousands of constant 1967 dollars. Wage data are from the 1980 PUMS, school characteristics are from the Biennial Survey of Education, percent rural from the Census, and income per capita from BEA. Data sources are described further in the appendix.

Table 5: Log Wage Percentiles, State x Birth-Year Cells

	Percentiles of log wage distribution		
	90-10	90-50	50-10
School size	0.0267	0.0086	0.0181
	(0.0237)	(0.0151)	(0.0181)
District size	0.0011	-0.0064	0.0075
	(0.0098)	(0.0064)	(0.0064)
State share of funding	-0.0715	-0.0546	-0.0169
	(0.0731)	(0.0461)	(0.0607)
Pupil-teacher ratio	-0.0065*	-0.0020	-0.0045*
	(0.0038)	(0.0024)	(0.0024)
Term length	-0.0024***	-0.0007	-0.0017***
	(0.0009)	(0.0007)	(0.0006)
Percent rural	0.0449	-0.1835**	0.2284***
	(0.1061)	(0.0760)	(0.0683)
Income per capita	-0.1266**	-0.0581*	-0.0685*
	(0.0495)	(0.0333)	(0.0364)
N	1440	1440	1440
R^2	0.64	0.67	0.33

Observations represent state-of-birth by year-of-birth cells for white men born in the 48 mainland states between 1920 and 1949. The dependent variables are differences between percentiles of the within-cell log weekly wage distribution. Observations are weighted by sample size. All models include state-of-birth and year-of-birth fixed effects. Robust standard errors, with clustering on state-of-birth, are reported in parentheses. The independent variables are state-of-birth specific averages over the years in which an individual born in a given year could have been in school, assuming a school starting age of 6 and a maximum of 12 years of schooling. School size and district size are measured as the log of average daily attendance in thousands. Income per capita is measured in thousands of constant 1967 dollars. Wage data are from the 1980 PUMS, school characteristics are from the Biennial Survey of Education, percent rural from the Census, and income per capita from BEA. Data sources are described further in the appendix.

Table 6: Log Wage Inequality, Less than H.S. Degree, State x Cohort Cells

	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
School size	-2.5969*	-0.0899**	-0.0568**	-0.0332
	(1.5105)	(0.0406)	(0.0251)	(0.0331)
District size	1.4462***	0.0388***	0.0140	0.0247**
	(0.4891)	(0.0132)	(0.0090)	(0.0103)
State share of funding	0.0505	0.0015*	0.0005	0.0010
	(0.0308)	(0.0009)	(0.0006)	(0.0008)
Pupil-teacher ratio	-0.1013	0.0017	0.0030	-0.0013
	(0.1606)	(0.0049)	(0.0031)	(0.0034)
Term length	-0.0956**	-0.0035**	-0.0008	-0.0028***
	(0.0443)	(0.0016)	(0.0011)	(0.0008)
Percent rural	17.0653***	0.3410**	0.0172	0.3238***
	(5.4168)	(0.1576)	(0.1045)	(0.1013)
Income per capita	0.8148	0.0712	-0.0398	0.1110*
	(2.1235)	(0.0680)	(0.0493)	(0.0639)
N	144	144	144	144
R^2	0.37	0.41	0.28	0.36

Observations represent 48 state-of-birth by 3 cohort-of-birth cells for white men born in the 48 mainland states between 1920 and 1949. The three cohorts are composed of men born from 1920-29, 1930-39, and 1940-49. The dependent variables are standard deviations and differences between percentiles of the within-cell log weekly wage distribution. Observations are weighted by sample size. All models include state-of-birth and cohort-of-birth fixed effects. Robust standard errors, with clustering on state-of-birth, are reported in parentheses. The independent variables are state-of-birth specific averages over the years in which an individual born in a given cohort could have been in school, assuming a school starting age of 6 and a maximum of 12 years of schooling. School size and district size are measured as the log of average daily attendance in thousands. Income per capita is measured in thousands of constant 1967 dollars. Wage data are from the 1980 PUMS, school characteristics are from the Biennial Survey of Education, percent rural from the Census, and income per capita from BEA. Data sources are described further in the appendix.

Table 7: Log Wage Inequality, H.S. Graduates, State x Cohort Cells

	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
School size	-0.5721	-0.0220	-0.0225	0.0005
	(1.6445)	(0.0412)	(0.0211)	(0.0414)
District size	0.6317	0.0229*	0.0087	0.0142
	(0.5104)	(0.0138)	(0.0068)	(0.0123)
State share of funding	0.0087	-0.0000	-0.0001	0.0001
	(0.0273)	(0.0008)	(0.0004)	(0.0010)
Pupil-teacher ratio	-0.0009	-0.0005	0.0015	-0.0020
	(0.1386)	(0.0044)	(0.0023)	(0.0040)
Term length	-0.0954*	-0.0026**	0.0001	-0.0027***
	(0.0530)	(0.0011)	(0.0006)	(0.0010)
Percent rural	-0.8966	-0.0513	-0.0400	-0.0113
	(5.4491)	(0.1336)	(0.0684)	(0.1368)
Income per capita	-1.9152	-0.0248	-0.0452	0.0205
	(2.8146)	(0.0660)	(0.0348)	(0.0664)
N	144	144	144	144
R^2	0.76	0.70	0.56	0.52

See notes to Table 6.

Table 8: Log Wage Inequality, Some College, State x Cohort Cells

	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
School size	-0.7259	-0.0023	0.0033	-0.0057
	(2.2001)	(0.0454)	(0.0329)	(0.0309)
District size	0.3792	0.0049	-0.0040	0.0089
	(0.6980)	(0.0132)	(0.0107)	(0.0128)
State share of funding	0.0027	-0.0005	0.0004	-0.0008
	(0.0622)	(0.0010)	(0.0006)	(0.0010)
Pupil-teacher ratio	-0.1315	0.0009	-0.0042	0.0051
	(0.2370)	(0.0053)	(0.0034)	(0.0049)
Term length	-0.1280**	-0.0034**	0.0008	-0.0041***
	(0.0512)	(0.0016)	(0.0011)	(0.0010)
Percent rural	-10.2049	-0.1147	0.0270	-0.1417
	(6.5009)	(0.1508)	(0.1001)	(0.0964)
Income per capita	-3.5269	-0.1327*	0.0377	-0.1704***
	(2.7131)	(0.0764)	(0.0612)	(0.0533)
N	144	144	144	144
R^2	0.75	0.83	0.79	0.51

See notes to Table 6.

Table 9: Log Wage Inequality, College Graduates, State x Cohort Cells

	SD of log wage	Percentiles of log wage distribution		
		90-10	90-50	50-10
School size	-0.2825	0.0216	0.0650**	-0.0434
	(1.8176)	(0.0498)	(0.0300)	(0.0341)
District size	0.8351	0.0126	-0.0162	0.0288***
	(0.5652)	(0.0170)	(0.0121)	(0.0109)
State share of funding	-0.0140	-0.0005	-0.0011	0.0007
	(0.0483)	(0.0017)	(0.0011)	(0.0010)
Pupil-teacher ratio	0.0332	0.0020	0.0055*	-0.0035
	(0.1675)	(0.0071)	(0.0030)	(0.0058)
Term length	-0.1372**	-0.0064***	-0.0023*	-0.0041***
	(0.0600)	(0.0020)	(0.0013)	(0.0013)
Percent rural	-8.0646	-0.2653	-0.1965	-0.0688
	(6.4896)	(0.2085)	(0.1625)	(0.1145)
Income per capita	-4.1669	-0.2705***	-0.1666***	-0.1038
	(3.5109)	(0.0992)	(0.0553)	(0.0643)
N	144	144	144	144
R^2	0.78	0.81	0.78	0.69

See notes to Table 6.