

EXPLAINING TRENDS IN HIGH SCHOOL GRADUATION:
THE CHANGING ELEMENTARY AND SECONDARY EDUCATION POLICY LANDSCAPE
AND INCOME INEQUALITY OVER THE LAST HALF CENTURY

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Abstract

Goldin and Katz (2008) document the key role that the educational attainment of native-born workers in the U.S. has played in determining changing returns to skill and income distribution in the twentieth century. Understanding the forces driving the supply of educated workers is thus critical. This paper focuses on the role of elementary and secondary educational institutions in the United States, which have changed dramatically over the latter half of the century, in determining high school graduation rates. In part, these institutional changes have been formally legislated and implemented as specific programs, but the programs alone do not explain the full extent of the dramatic rise in spending. I review relevant literatures and policy history, and present original descriptive analysis of the role of income inequality in shaping graduation and spending from 1963 to 2007. Results suggest that inequality, which previous research establishes as negatively correlated with the establishment of public secondary schooling earlier in the twentieth century, was positively correlated not only with education spending levels but also with aggregate high school graduation rates at the state level. This relationship holds with inequality at the bottom of the distribution as well as at the top.

I. INTRODUCTION

In *The Race between Education and Technology* (2008), Goldin and Katz comprehensively examine the forces behind changes in returns to skill in the U.S. over the twentieth century. Their title summarizes key forces influencing the supply of and demand for skilled labor. They write, “Our central conclusion is that when it comes to changes in the wage structure and returns to skill, supply changes have been critical, and changes in the educational attainment of the native-born have driven the supply side.” This paper examines one dimension of the puzzle remaining at their conclusion: why did high school graduation rates plateau in the latter portion of the twentieth century? Labor economists study this pattern in the context of increasing returns to skill; though returns to a high school diploma itself have diminished, it continues to serve as a gateway to college and its associated increasing labor market rewards. In this paper, I focus on the role income inequality may have played in affecting graduation rates, and whether it did so in part through educational institutions.

In contrast to Goldin and Katz (2008), who find that income inequality slowed the local establishment of public high schools from 1910 to 1938, recent evidence (Boustan et al., 2012; Corcoran and Evans, 2010) shows that increases in income inequality at the local level from 1970 to 2000 increased elementary and secondary school spending. In this paper, I review major changes in education over the past half century, including a massive aggregate increase in school spending, the decline in the inequality of resources across local school districts, and the civil rights focus on various groups of students historically less likely to graduate. I then describe the relationships between within-state income inequality and mean state spending on state-level graduation rates and, separately, school spending, to see if the data suggest any part of the increases in spending induced by inequality went toward productive investments in students on the margin of dropping out. Following the plateau in graduation rates, what appears to be an uptick since 2000 sparks further speculation about the relationship between education policy and graduation outcomes.

Becker's model of human capital provides a useful starting point for considering potential determinants of high school graduation and educational attainment more generally. Individuals optimize their investments in human capital by considering the expected costs of acquiring it and the stream of returns they anticipate earning from it. School quality, as determined by inputs and technologies, can affect both costs and benefits. Much of the education literature implicitly assumes that improvements in school quality reduce psychic costs of human capital acquisition by making the school experience more enjoyable or effective, and thus considers graduation to be an indicator of school quality, holding the demand for skilled labor constant.¹ If the skill level of the entire workforce is increasing—whether due to the increasing returns to skill we see over this period (Freeman, 1976) or improvements in school quality—excess supply of skilled labor could depress returns to the point that individuals anticipating this response would lower their investments in human capital. I confine my discussion to the potential impact of changes in the supply of education, rather than labor market-induced changes in its demand, though of course both forces shape individual decisions about attainment.²

High school graduation rates are a relevant outcome for several reasons. As a measure of human capital, they have implications for productivity and economic growth. Studies of high school dropout point to the importance of achievement levels at younger ages, so studies of high school graduation can indirectly allow us to study the elusive education production function, at the elementary and early childhood levels as well as the secondary level. The extent to which educational inputs are associated with student outcomes has long been a popular question among researchers, the media, policymakers and the public, most prominently emerging with the Coleman

¹ Intended improvements in schools could well make schooling more costly, however. Changes in educational production could improve achievement *conditional on constant enrollment* but discourage enrollment and ultimately attainment, potentially to the point that the net effect is negative: consider high school exit exams, longer school days and years, or longer commutes to non-neighborhood schools due to desegregation or choice policies.

² For the evolving return to high school graduation and postsecondary education over this period, see Autor, Katz, and Kearney (2008).

Report in 1966 and defining an entire subfield of the literature studying what are known as education production functions. The central difficulty in this literature—which I will not surmount in this paper—is identifying exogenous sources of variation in educational inputs. Depending on the choice and measurement of inputs (e.g., school spending, class size, teacher salary) and outcomes (levels or gaps, achievement or attainment, exceeding minimum proficiency levels or more finely detailed distributional measures), researchers debate the extent to which outcomes have improved, stagnated, or declined with increased inputs. Many conclude that money does not “matter” in the production of education (e.g., Hanushek, 1997), though this assessment of the literature is far from universal (e.g., Krueger, 1998).

One natural extension to this line of questioning is how what one *does* with the money (in the language of Goldin and Katz, productivity versus resources alone) matters. Here researchers have had more success in constructing methodologies to credibly identify causal impacts, though often in highly specific contexts not readily amenable to generalization. They also have more frequently estimated statistically significant positive relationships between specific inputs and student outcomes, perhaps most notably with Project STAR’s experimental design randomly assigning Tennessee students to smaller and larger classes. A major recent emphasis in this literature is a focus on the impact of individual teachers characterized by their “quality” based on past value-added to student achievement (e.g., Rockoff, 2004). At least in part as a response to some of this research, major education policy initiatives at the state and federal levels currently focus much more on encouraging the use of particular “scientifically-based” inputs or practices rather than on increasing—or maintaining, in the current budgetary climate—levels of overall resources.

This paper focuses on one outcome, the high school graduation rate, so I emphasize at the outset that there are multiple ways an individual could change investments in human capital without changing one’s status as a high school graduate or dropout: for example, dropouts or graduates can exert variable levels of effort and correspondingly acquire different skills and levels

of proficiency, and graduates could attain more or less post-secondary schooling. High school graduation does in most cases serve as a gatekeeper to postsecondary education, however, so high school graduation trends can influence trends in postsecondary attainment as well (see Heckman and LaFontaine, 2010).

Figure 1 replicates Goldin and Katz's Figure 9.2, which shows high school graduation rates from 1890 to 2000. These rates grow throughout the period until peaking at 77 percent in 1969.³ The period from 1910, when only 8 percent of students graduated from high school, through 1940, the first year in which the median student continued through graduation, is known as the "high school movement" during which public high schools were established in local school districts throughout the nation. In *The Race between Education and Technology*, Goldin and Katz analyze differences in geographic trends in these rates, establishing important roles both for factors which affected family demand for education (manufacturing job prospects related to the opportunity cost of education, and average income) and the likelihood that local school districts would reach consensus to provide a public high school education (income inequality, and the stability of a community, proxied for by the share of the population over age 64). Graduation rates continued to increase through 1969 followed by what Goldin and Katz describe as subsequent "backsliding" and then plateau.

Figure 2 shows national and regional graduation rates from 1963 to 2007. I define these rates using data from educational agencies with counts of high school graduates as the numerator and counts of students enrolled in eighth grade five years earlier as the denominator, and exclude GED recipients from the defined group of high school graduates.⁴ On average, 76.5 percent of U.S. eighth graders persisted to graduate from high school in 1963. This increased to 81.7 percent by

³ Goldin and Katz calculate these rates by dividing annual counts of graduates from education agencies by the age-appropriate (17 year old) population at the state level.

⁴ As Heckman and LaFontaine note, this may be impossible for some observations in which states include GED recipients in the administrative counts of high school graduates reported to NCES annually; they give New Jersey as one such example.

1969, but dipped below the 1963 level, to 76.1, by 1979. By 2007 the national rate was 78.7 percent, similar to the 1991 level and only 2.8 percent higher than in 1963.

The relevant question for studying how the supply of elementary and secondary education relates to graduation rates in the latter part of the twentieth century changes from that asked by Goldin and Katz of the high school movement—why did some places establish high schools sooner than others?—to whether variation in intensive measures of the supply margin, such as school spending, days of schooling per year, and teacher characteristics, helps explain variation in graduation rates. Might the same forces underlying the initial establishment of public high schools, most notably income inequality, continue to promote school quality decades later and thus correlate with higher graduation rates? While I am primarily interested in elementary and secondary school quality as a mechanism for these relationships, the descriptive nature of this investigation precludes any causal conclusions. Most importantly, I cannot determine the extent to which income inequality affects graduation via school quality (or other factors affecting human capital acquisition prior to or concurrent with formal schooling), or due to labor market expectations based on changing returns to skill shaping demand for schooling.

In Section II, this paper summarizes what we know about trends in high school graduation and the forces behind them, from analyses of both aggregate and microlevel data. I then describe major changes in American elementary and secondary education over the past half-century and how they might be expected to affect high school dropout in Section III. Section IV presents a descriptive analysis of the relationships among education policies, demographics, and high school graduation rates at the state-year level. Section V concludes by discussing other potential explanations for observed graduation patterns and future policy directions for improving educational attainment.

II. TRENDS IN HIGH SCHOOL DROPOUT AND WHAT (LITTLE) WE KNOW ABOUT ITS CAUSES

A. *Literature on Aggregate Trends in High School Graduation*

Heckman and LaFontaine (2010) present a comprehensive review of the literature describing high school dropout. They note that much of the literature focuses on levels and gaps at a point in time, rather than on demonstrating historical trends, and emphasize the widely disparate levels reported across studies for ostensibly the same groups at the same points in time due to different approaches to measuring the graduation rate. These differences matter for first-order questions about the nature of trends in aggregate levels and gaps across groups, as well as in calculating estimates of returns to education and trends in inequality over time. One central difference across measures used by researchers is whether they are derived from measures of educational attainment in the adult population, backing out graduation cohorts from respondents' ages, or are based on counts of high school graduates produced by education agencies, relative to estimates of a cohort's size (measures used for reporting to state and federal government fall into the latter category). Within each of these approaches, there are a number of variations based on data sources.⁵ Depending on the time period of interest and desired level of geographic and demographic aggregation, researchers often do not have a choice among measures.

Heckman and LaFontaine show that these discrepancies across data sources—including Census and CPS data used to measure attainment in the adult population, administrative data on graduates and completers (the latter group includes General Equivalency Degree (GED) recipients) from educational agencies, and longitudinal research samples—can be resolved by ensuring that both the numerator and denominator of the high school graduation rate meet uniform criteria.⁶

⁵ In particular, there is much discussion in the literature normalizing a school system's graduate counts by a cohort's enrollment in that system in previous years about which grade to use as a proxy for cohort size. Increased likelihood of retention in grade nine makes the choice of grade nine versus eight or ten, or an average, matter in some cases. See Swanson (2004).

⁶ They focus on a sample that includes all students attending school in the US and only those students—including those later incarcerated, and excluding immigrants who arrive in the US after completing their

They report trends quite similar to those reported by Goldin and Katz and shown in Figure 1 of this paper, with graduation rates peaking around 1970.

To get a sense of just how much measurement choices can yield differences in first-order characterizations of these patterns, consider that Mishel and Roy's (2006) analysis of CPS data from 1962 to 2004 describes "remarkable progress in raising... high school completion rates." This qualitatively different assessment hinges on the use of completion (defined to include GED reciprocity) as an outcome rather than high school graduation. Their estimated trends differ qualitatively from those in Figure 1 throughout the time period and do not exhibit a peak around 1970. Murnane (2012) follows the general strategy of Heckman and LaFontaine while incorporating more recently released data from the American Community Surveys of 2002-2010; this exercise reveals an increase in graduation (not completion) rates from later, 2000 to 2010, while confirming the general aggregate trend identified by Heckman and LaFontaine (and, again, generally consistent with Figure 1) prior to 2000. Overall, the analyses of *graduation* rates by Goldin and Katz, Heckman and LaFontaine, and Murnane identify very similar trends as each other and as I do later in this paper.

Within the aggregate graduation trend, Figure 2 reveals significant regional variation. The most immediately visible regional deviation from the national average is in the South, which started out behind in the 1960s with a 63 percent graduation rate compared to rates exceeding 80 percent in the three other Census regions. This is unsurprising given the inferior educational opportunities available to blacks in the South, but, as Goldin and Katz and others note, also was due to poor outcomes for Southern whites. Though the South did experience brief periods of decline subsequently, the general trend over the decades was much more positive than in the other regions, with the graduation rate reaching 75 percent by 2007. Trends for the Northeast and Midwest were relatively similar to one another, starting out high (at 83 and 82 percent respectively in 1963) and

schooling, for example—and use administrative data on GED test-takers to exclude GED recipients from high school graduate counts derived from Census data.

peaking soon after before prolonged decline. By 2007, graduation rates had not yet returned to their peaks, with rates of 85 percent in the Northeast and 84 percent in the Midwest. The West, which started out with the highest graduation rates of any region at 85 percent in 1963, experienced the greatest decline over the period, and is the sole region ending the period far below its initial level, with only 75 percent of students graduating in 2007. Differential demographic trends are one obvious potential explanation for such regional differences; consider, for example, increased immigration and enrollment of language minority students in the West. How demographics affect graduation rates also could be changing over time differentially across regions; for example, the remarkable improvement in attainment in the South is likely related to the impact of desegregation. Regional differences could also be attributable to different trends in the level and distribution of school resources. The data analysis in Section IV begins to examine these questions.

B. Literature on Factors Influencing Graduation Rates

Little of the literature attempting to disentangle the determinants of high school graduation (often framed as understanding dropout, rather than graduation) tries to do so by understanding long-term historical trends. Goldin and Katz's analysis of the high school movement points to the importance of both supply and demand factors for early adoption of public secondary schooling and graduation rates (see their Table 6.1). The mechanism for generating variance in high school graduation rates in these early decades is a first-order one: one is more likely to graduate from high school if one has access to a free public secondary school.

One related contemporary literature asks what forces shape gaps in graduation rates across demographic groups (but still at aggregate levels) over time. Although recent work points to the growing importance of socioeconomic gaps in educational outcomes (see Reardon, 2011), racial gaps have received more attention in the accumulated literature to date. These attempts have generally concluded that trends in black graduation rates drive the observed trends in the gap, and that much of the timing of this stagnation and reversal is unexplained (see Neal, 2006; Haskins,

2008), though some of it can be attributed to policy changes (see Vigdor and Ludwig, 2008, on the role of school segregation levels). Recent work by Evans, Garthwaite and Moore (2012) proposes the crack cocaine epidemic as an explanation for this timing. In this paper, I focus on aggregate trends rather than trends within or gaps across groups to study a longer historical period, including earlier years in which administrative graduation data disaggregated by demographic groups are not available.

Another literature investigates determinants of graduation outcomes at the individual level. Such research is necessarily limited to years in which sufficiently rich micro-level data are available, and cannot provide annual estimates like the literature on gaps or aggregates. This cost comes alongside the considerable benefit of richer data. Recent work by Altonji and Mansfield (2011) analyzes two such databases, the National Educational Longitudinal Survey (NELS: 1988), which tracks the spring 1988 eighth-grade cohort slated for “on-time” high school graduation in 1992, and the Education Longitudinal Survey (ELS: 2002), which tracks the spring 2002 tenth-grade cohort who would graduate on time in 2004. They assess the correlations between students’ home, school and community characteristics and their likelihood of graduating from high school. They emphasize that they cannot estimate the causal impact of these factors, but rather are illuminating the extent to which school and community characteristics have explanatory power beyond aggregating individual characteristics. This distinction is crucial, particularly in the context of highly publicized research describing so-called “dropout factories”—the public high schools with disproportionately high concentrations of poverty, concentrated in Northeastern cities and in the South—that Balfanz and Legters (2004) show disproportionately “produce” the nation’s high school dropouts. If the school-level socioeconomic characteristics of these high schools exert a significant and negative independent force on graduation rates *after* controlling for the independent role of those same variables at the student level, policies to reduce the concentration of poverty in schools—for example, school desegregation by poverty, income, or other sufficiently

highly correlated student characteristics—could improve graduation rates absent any reduction in child poverty rates. Alternately, if school-level demographics appear to operate primarily through the aggregation of individual-level characteristics, one would look primarily to public policies aimed at poverty itself to improve educational attainment.

Altonji and Mansfield find a statistically and economically significant relationship between school and community characteristics⁷ and the likelihood that any given student will graduate from high school.⁸ They also examine the across-school variance in the composite quality measure for both these cohorts and the high school senior class of 1972, revealing significant increases in between-school variance from 1972 to 1993, and a slight increase from 1993 to 2005. This is consistent with the documented trend of increased residential segregation by income over that time period (Watson, 2009), given the dominance of residentially determined school attendance and the authors' use of peer socioeconomic characteristics as an input into their composite school quality measure. Altonji and Mansfield emphasize, however, that for both the NELS and ELS cohorts the relationship between *school and community* characteristics and individual dropout behavior is much weaker than the relationship between *individual* students' characteristics and dropout outcomes. Among individual students' characteristics affecting within-school probabilities of graduation, the typical observable characteristics—family structure and various components of socio-economic status—matter, and unobservable characteristics explain even more of the variance. Their results therefore suggest that increased income inequality over time would be negatively correlated with graduation rates, but is not the primary mechanism behind the individual outcomes for those students at the bottom of the income distribution.

⁷ These characteristics include both student characteristics aggregated up to the school level, and school characteristics such as teacher turnover and student-teacher ratios. They combine these characteristics into a single dimension of school quality, as determined by what predicts student outcomes, by which they rank schools.

⁸ Specifically, they estimate that moving a given student from a high school at the 10th percentile of the school quality composite index to the 90th percentile is associated with being seven percentage points more likely to graduate from high school in the NELS: 88 cohort, for whom the average dropout rate was nine percent, and nine percentage points more likely in the ELS: 2002 cohort, for whom the average dropout rate was ten percent.

III. A BRIEF HISTORY OF RECENT CHANGES IN U.S. EDUCATION POLICY AND TEACHER LABOR MARKETS

Systems of public elementary and secondary education finance and governance in the U.S. today differ markedly from those in place in the decades when graduation rates were climbing. Some of the most prominent policy changes—for example, court-ordered desegregation, state-level school finance equalization reforms, and the federal requirement of a free and appropriate education for students with special needs—were designed with the intent of improving educational outcomes for specific groups; these students were also those historically less likely to graduate from high school. To affect graduation rates, these policies would need to reach those targeted students and to engender effective changes in educational practice, neither of which are straightforward goals. Whatever funds “stick” to district budgets must be allocated across schools within districts (this is relevant even for districts with one high school, given the correlation between academic achievement prior to high school and persistence to graduation), and within schools, allocated to particular instructional settings and therefore not benefiting all students in the school uniformly. We know relatively little about both these processes and how they may have changed over this time period.

Alongside federal, state, and local changes in elementary and secondary education policy over these years came significant changes in the teacher labor market and in the demographic composition of students. As attractive labor market options beyond teaching have expanded for college-educated women, they have disproportionately drawn women from the upper part of the distributions of various measures of cognitive skill from the pool of potential teachers. Changes in family structure have led to increasing numbers of students coming from single-parent homes, which is positively correlated with high school dropout (McLanahan and Sandefur, 1994). The time-series data alone, showing stagnating graduation rates alongside major education policy initiatives,

thus do not necessarily imply that we are not better off with particular reforms than we would have been without them.

In the following subsections, I detail key changes in federal, state, and local revenues and programs. Many of these changes are captured by Figure 3, which shows the evolution of revenue and spending per pupil. For most of the United States' history, and in most states, the vast majority of school spending was funded through locally generated revenue streams.⁹ This reliance on local revenue was accompanied by a great deal of local control. Though states assume constitutional responsibility for education and have no obligation to allow local control, they historically have devolved much of education governance to local districts, while retaining control over decisions such as ages of mandatory attendance, minimum required days per school year, and requirements for teacher credentialing at the state level (Briffault, 2005). Over the same time period that graduation rates declined and stagnated, centralization increased in school finance, with increased roles for the federal and state governments.

Figure 3 and Table 1 also reveal the marked increase in school spending over the past half-century. The national average for current spending (excluding capital investments), discussed throughout in per pupil terms in 2009 dollars, rose from under \$500 to over \$11,000 from 1963 to 2007. This has not gone unnoticed: education policy discussions nearly always frame trends in achievement and attainment in the context of this dramatic increase. The rest of this section discusses major changes in federal, state and local policy, as well as changes in teacher labor markets.

⁹ Local revenue refers to that generated at the school district level. In the minority of states in which school districts are "dependent" on parent governments such as counties, cities, or other local governments, the taxes are levied and revenue collected by the parent government rather than by the school district itself; for both independent and dependent districts, "local" revenue is raised from the geographic area contiguous with the school district.

Changes in federal education policy

The federal role in elementary and secondary school finance initially emerged in a significant way with the Elementary and Secondary Education Act (ESEA) of 1965. ESEA, and its largest program, Title I, changed the nature of federal education policy in three key ways. First, it was a sizeable amount of revenue for some districts. The federal government provided funds to districts (always via their state education agencies) earlier through a few categorical programs, with Aid to Federally Impacted Areas and the National Defense and Education Act as the largest funding streams, but these other sources together totaled only about 3 percent of what the average district spent. Southern districts, with their high poverty rates, benefited disproportionately from Title I, with program revenues equal to about 15 percent of pre-existing spending levels in Southern districts. While Title I significantly increased federal spending, however, it is important to remember that all federal revenue still constitutes just under 10 percent of total school district revenues in the US today.

Second, the Title I program aims to provide compensatory education and is explicitly designed to be redistributive, with funding based primarily on child poverty counts in a district. Title I as a share of spending has therefore always varied by district. In Figure 3, we see the average change, with federal revenue overall accounting for 7.9 percent of spending in 1965 compared to 4.4 percent just the year before. The extent to which Title I redistributed resources to less advantaged *students* remains an open question. It would first need to resist crowd-out of state and local revenues to supplement spending at the district level. Cascio, Gordon, and Reber (forthcoming) show that nearly half of Title I revenues did ultimately supplement local spending on average in the late 1960s, and significantly more so in districts experiencing larger shocks from Title I grants relative to their existing budgets. Gordon (2004) shows that this was unlikely by the mid-1990s. Conditional on “sticking” to school spending at the district level, Title I funds might not make their way to the most disadvantaged students within districts—who are disproportionately

those on the margin of choosing to drop out of high school. Cascio, Gordon and Reber examine the South of the 1960s and find that Title I-induced net increases in district-level spending were associated with improvements in high school graduation rates for whites but not blacks. Extensive qualitative data publicized by advocates from the NAACP Legal Defense Fund also suggests that local officials often found ways to use federal funds in unintended ways (Martin and McClure, 1969).

The regulatory framework meant to ensure that funds make their way to the most disadvantaged students has grown more logistically complex and legally binding over time, but recent work (Roza, 2010; Heuer and Stullich, 2011) suggests that the (generally opaque to the researcher) ways in which districts allocate resources across their schools have tended to offset the redistributive intent of the Title I program. This clearly violates spirit of the law and its regulations. Further, the accounting systems of state and local education agencies make it difficult to capture resources in dollar units (as opposed to full-time equivalent staff, or FTEs) at the school level. Federal regulators thus allow districts to comply with Title I by smoothing FTEs rather than dollars across schools before layering on Title I funds, in what is known as the “comparability loophole.”

Third, and perhaps most significantly, offering such sizeable grants allowed the federal government to require that school districts meet conditions of their choosing in order to receive the funds, providing a mechanism for the federal government to intervene in a policy sector in which it otherwise has no constitutional right to do so. This conditionality of funding was most relevant at the inception of Title I not in the context of ensuring that funds benefited disadvantaged students within a district (to which the federal government devoted little effort at the time) but rather in enforcing the desegregation requirements legislated in the Civil Rights Act of 1964, which withheld federal funds to discriminatory public agencies across policy functions (see Cascio et al., 2010). Most recently, the 2001 reauthorization of ESEA as the No Child Left Behind Act withholds Title I funds from states that fail to establish accountability systems meeting its requirements. This

prompted resistance from states and districts that have come to rely on Title I funds, litigation, and ultimately a ruling from the U.S. Court of Appeals for the Sixth Circuit that NCLB provides conditional aid rather than an unfunded mandate and is therefore legal (*Pontiac v. Spellings*, 2009). Research suggests that the net impact of NCLB on achievement is neutral to positive, depending on the outcomes measured (Dee and Jacob, 2011). Overall, the use of conditions with federal funds has magnified their influence beyond that implied solely by the relatively small share of total revenue they constitute.

While some of the increase in federal funding over time has come through increases in allocations to the Title I budget, new federal programs have also contributed to the rise. Perhaps more notable than the funds provided by these programs is their categorical nature and the extent to which they have attempted to force local districts to channel resources to groups of (variably defined) disadvantaged students. The introduction of federal categoricals was followed by increasing numbers of states adopting more categorical funding streams. If this relationship is casual, the impact of federal funds extends far beyond dollars appearing as federal revenue in district financial reporting. These categorical programs are notable for the various groups they aim to serve and to whom they provide legal recourse; the amount of funding provided through them, however, is generally small compared to all federal education revenue, which is in turn small compared to total education revenue.

The introduction of new programs, with the exception of ESEA, thus generally does not register as remarkable in the time series of federal revenue or current spending displayed in Figure 3. For ease of reference, the figure does not note all programs; close examination reveals noticeably *absent* upticks for new programs for the Individuals with Disabilities Education Act of 1970, in 1972 for Title IX promoting gender equity, and in 1968 for the Bilingual Education Act (see Gordon, 2008 for more detailed discussion of these and other federal education programs). Some of the most significant federal interventions in elementary and secondary schooling in these decades

comes through the federal judicial actions to desegregate schools (see Cascio, Gordon, Lewis and Reber, 2008 for further discussion); these mandates do not appear as revenue either, though desegregation has been associated with increased likelihood of graduation for blacks (Guryan, 2004; Reber, 2010).

Also not shown in the historical time series of Figure 3 is the most recent increase in federal education funds, much of which was due to the American Recovery and Reinvestment Act (ARRA). Rather than solely expanding funding for existing programs, such as the traditional form of ESEA Title I, the ARRA funds were targeted to several new initiatives that differ qualitatively in their approach to the federal role in education. Two of the ones that are most significant, in both the magnitude of funds allocated and in their departure from the traditional structure of federal aid, are the School Improvement Grants and Race to the Top programs.

School Improvement Grants (SIGs) are similar to the federal Comprehensive School Reform (CSR) grants program of the 1990s but on a much larger scale. Both SIGs and CSR often channel funds through school districts to private contractors for tasks—related to school management, curriculum, and instruction—typically carried out by public school and district employees. While for many years discussions of privatization in schooling centered around the theoretically interesting potential for vouchers, the advent of SIGs point to an increased role for private vendors operating within what are still public schools. Burch (2006) describes how private suppliers increased following accountability reforms prior to SIGs; Forbes and Gordon (2012) show how competitive markets for private suppliers of intermediate goods in education markets may not lead to improvements in school quality.

The Race to the Top (RttT) program innovates by bringing a tournament model to federal education funds, while retaining the traditional flow of revenues from the federal government to state education agencies (or, in the most recent round, directly to local education agencies). While ESEA at its inception in 1965 offered the carrot of Title I funds to all agencies meeting its conditions

(most bindingly, its desegregation requirements), RttT is explicitly a competition, laying out a menu of how agencies can accumulate points for their proposals in exchange for implementing policies in advance or including specific practices in their grant proposals. This appears quite cost-effective. The prospect of “winning” the race—as much as \$700 million for large states like Florida and New York—prompted many states to change politically entrenched policies, though fewer than half the states have successfully won any of the three (to date) rounds of the race and ultimately received a grant.

Overall, the federal level has emerged as a policy force since the 1960s, more than doubling its share of education revenue and shaping local policies via civil rights protections and conditions of aid. Despite this increase, the magnitude of federal funds has remained low enough that they do not explain the massive growth in school spending witnessed over the full span of this period. For this, we turn next to state policies.

Changes in state education policy

Figure 3 also shows a climb in the share of total revenue coming from the states beginning around 1970. In many cases, these increases were prompted as part of school finance reforms that increased the progressivity of state formula aid (not visible within this figure), and were often in response to state level judicial mandates. These court rulings have overturned the constitutionality of school finance systems in the majority of states to date, often multiple times within a state; see Corcoran and Evans (2008) for more details and a listing of cases. The first such ruling, with some of the most dramatic consequences, came in 1971’s *Serrano v. Priest* decision by the California Supreme Court. This is marked on Figure 3 as “Serrano I” to distinguish it from subsequent rulings in 1976 and 1977, known as Serrano II and III respectively, which sparked more dramatic reforms.

While the reforms to school finance following such rulings have differed substantively across states and over time (Hoxby, 2001), Murray, Evans, and Schwab (1998) show that on average, these rulings have been associated with increased spending per pupil and increased

progressivity of spending within states.¹⁰ Card and Payne show that court-ordered school finance equalization (SFE) reforms increased the progressivity of spending within states and narrowed the gap in SAT scores by family income in affected states. SFEs could increase the observed progressivity of spending (where the district is the smallest unit observed) without necessarily affecting graduation rates if funds are disproportionately directed to higher achieving students, such as future SAT takers, rather than students on the margin of dropping out.

States have exerted their influence over local districts historically through compulsory attendance laws (albeit with generally weak enforcement) and teacher credentialing requirements. More recently, states adopted curricular standards and subsequently imposed accountability systems with assessments at least nominally aligned to their standards, in many cases before they were required to do so by No Child Left Behind (which was modeled on existing state programs) if they wanted to continue to collect Title I funds. As new dimensions emerge in education policy, state regulations do so as well. For example, states are increasingly involved in homeschooling and online learning.

Local policies and practices

Traditionally, the local school district was the dominant political jurisdiction in determining total revenue and policy choices. The most readily identifiable changes in education policy in recent decades have been major state and federal initiatives, in part because of their inherent scale. This is not to say that school districts have not innovated; some large school districts have done so in highly visible ways, such as using value-added components in teacher assessments and compensation in Denver and Washington, D.C. But local districts ultimately implement instructional programs and the effects of “big” federal and state programs depend critically on how school districts crowd out intergovernmental grants and use any net additional funds or work towards newly defined goals.

¹⁰ California is a notable exception. See Fischel (1989) on the relationship between its school finance reform and the subsequent passage of Proposition 8, limiting growth in property tax revenues.

The extent to which school districts have crowded out state and federal intergovernmental grants by reducing local revenues appears to vary considerably, as discussed in the federal and state policy sections above. And while researchers have long acknowledged the importance of local implementation (McLaughlin, 1976), we continue to know remarkably little about how most districts allocate resources across schools and how schools allocate resources across students (Roza, 2010).

A series of studies by Marguerite Roza and colleagues (see Roza, 2010 for a summary) is particularly illuminating of crowd out *within* school district budgets, when grants from state or federal governments nominally are allocated to typically disadvantaged schools meeting the relevant qualifications for different categorical programs, but unrestricted funds (e.g. from local revenue) are disproportionately allocated to schools receiving less aid from higher levels of government via categorical programs.

While it would be fascinating to look at the distribution of within-district allocations for a large sample of school districts and over time, this type of large sample school-level analysis is impossible based on existing data sources. Guin et al. (2007) use administrative data from the Texas Education Agency from 1994 to 2003—unusual in detailing district-level allocations to schools in dollars rather than full-time equivalent staff—and find that the variance in spending per pupil found *within* districts exceeds that measured *across* districts in Texas. School finance reform in Texas led to a system with a high degree of redistribution across districts, so other states likely have greater cross-district variance. There is no reason to expect, however, that extensive within-district variance in resources at the school level is specific to Texas or to this time period.¹¹

Figure 4, reproduced from their study, shows how dollars from different funding streams are allocated across one anonymous Texas district. It shows how schools with low poverty rates get

¹¹ The information systems are simply not in place, even administratively, to conduct such analyses for earlier time periods and in many other states. In the majority of cases, such analysis would require access to multiple administrative data systems at the district rather than state level (e.g., one database to determine individual teachers' salaries and another for their school placements).

more state and local revenue than poor schools, which get a disproportionate share of their resources via federal funds. This violates the intention of Title I—to supplement resources for poor students, already equalized at the district level. Because of the comparability loophole discussed previously, however, it is technically legal. It is also quite difficult for districts to avoid given standard human resource policies. Districts typically open up new teaching positions first to teachers already working within the district. Teachers new to the district often enter through low SES schools, then transfer to higher SES schools as positions open. This leaves high poverty schools with a disproportionately inexperienced—and therefore cheap—workforce. Were districts to equalize spending in dollars, rather than FTEs, across schools, class sizes in low poverty schools would so far exceed those in high poverty schools as to be politically infeasible.

I can only speculate on trends in within-district inequality of resources over time given the scarcity of data at the school level. If anything, policy changes in recent decades may have helped lower performing schools, as the stakes and transparency of accountability systems might have pushed districts toward targeting low-achieving students and the schools in which they are disproportionately clustered.

Changes in the labor market for teachers

The most recent direction for researchers studying education production functions is trying to identify teacher quality as an output-based measure. The main conclusion of the literature to date is that there is high variance in teacher quality, most of which is unexplained by observable characteristics, and therefore unfortunately does not yield clear policy implications for teacher selection or training. This literature prompts the question whether any stagnation in educational outcomes, such as graduation rates, might be attributed in part to stagnation or decline in teacher quality. A related literature examines the role of women's labor market conditions and the labor supply of teachers, and concludes that expansions of labor market opportunities for college-educated women in recent decades have resulted in a teaching workforce that looks considerably

less competitive than it used to (see Bacolod, 2007; Corcoran, Evans, and Schwab, 2004; and Hoxby, 2004).

IV. INCOME INEQUALITY AND HIGH SCHOOL GRADUATION

Duncan and Murnane (2011) set out a comprehensive model for how income inequality can affect educational outcomes, including its impact on home, community, and school environments. This model suggests that inequality could affect educational outcomes, including graduation rates, even conditional on the educational setting experienced by students, by, for example, depressing student expectations. Overall, the economics literature has contributed mainly to the mechanism in this larger model by which demographic heterogeneity, including income inequality, affects demand for public spending. Determining the existence and potential direction of this effect is not straightforward, theoretically or empirically.

The main theoretical ambiguity comes from two models with opposite predictions. Empirical work by Goldin and Katz (1997, 2008), Poterba (1997), Alesina, Baqir, and Easterly (1999), and Luttmer (2001), among others, supports a model in which fractionalization reduces support for public spending because voters do not wish to subsidize those outside of their own group. Alternatively, the median voter theorem, in the context of a uniform tax rate, predicts that as mean income rises relative to median income and lowers the tax price (or tax share) of public spending for the median voter, demand for public spending should rise. Two recent papers investigating the relationship between changes in income inequality at the local level and school spending in the U.S. in recent decades both find support for the latter theory dominating empirically (Corcoran and Evans, 2010, henceforth CE; Boustan et al., 2012, henceforth BFWZ).

It is likely that the relative importance of the two opposing theoretical forces varies with the historical policy context. Goldin and Katz (1997, 2008) find that high schools were established earlier—and graduation rates rose earlier—in states with less inequality early in the twentieth century, while CE and BFWZ show greater income inequality within localities is associated with

more demand for public spending in the latter part of century. Measurement and aggregation issues aside, this discrepancy could be resolved if salient major infrastructure investments—like establishing a public high school—require reaching a higher threshold of political consensus than do incremental increases in revenue used to fund continuous changes in the level of school spending. CE examine the relationship between inequality and private school enrollment, which they note could reflect a perception of low quality public schools but also a desire to segregate. BFWZ's analysis is solely of fiscal variables.

I next examine correlations between state-level inequality and high school graduation rates from 1963 to 2007. These could operate through the spending increases CE and BFWZ attribute to inequality, or through other channels. For example, the positive established relationship between income inequality and income segregation combined with the residentially based school attendance policies of most districts could make increases in inequality translate into an increase in school segregation by income, which might independently affect graduation rates conditional on spending levels.

There are advantages and disadvantages to conducting this type of exercise at both the state and local levels. In this case, because I want a panel covering the universe of students in the U.S. as far back as possible, and construct my preferred graduation rate from the ratio of current graduates to eighth grade enrollment five years earlier, data requirements dictate that I conduct the analysis at the state level. In addition to being more readily available, state estimates of the graduation rate defined in this way will suffer only from measurement error due to mobility across states and the public or private sector, rather than also across districts.

Analysis at the state level yields more interpretable results when the median voter in the state, rather than the school district, drives the level of school spending; the trade-off is that analyzing local jurisdictions yields more interpretable results in states with more Tiebout-style finance systems (as in the earlier decades analyzed by Goldin and Katz). All states provide some

funding to local districts, however, and local revenue towards school spending is determined in the context of state school finance systems that penalize or reward local contributions, to varying degrees.

The state level of analysis also has significant drawbacks: it obviously provides far fewer observations, and masks the considerable within-state heterogeneity in both key independent and dependent variables. As CE and BFWZ point out, there is more variation in inequality over time during these years within school districts than within states.¹² And while the presence or absence of a court-ordered school finance equalization is appropriately measured at the state level and may well affect mean educational inputs in a state, its impact within any given district is likely to vary from the state average depending on the extent to which the reform redistributes funds to that specific district—generally, a function of the property wealth per pupil in the district relative to the state average. Reforms that do not change state means could still change inputs in those districts with students disproportionately on the margin of high school.

I use state-year level data to describe correlations between high school graduation rates and income inequality, controlling for basic demographics (median income and percent nonwhite). I then apply the same framework to examine relationships between inequality and education spending per pupil. For both sets of analyses, I allow court-ordered school finance reforms to mediate the impact of inequality. The analysis is of state-level aggregates of current spending, so it reflects combined revenue decisions at federal, state, and local levels.

The major caveats to this empirical exercise also apply to decades of research on education policy: first, inputs are endogenous to the preferences of voters in the state and its districts (CE and BFWZ take considerable care with this issue); second, there is variation in inputs at the student level within states, districts, and schools, so the average level of school spending does not

¹² Following Roza (2011), moreover, there is considerable variation in resources allocated to students even within the same schools, so the disaggregation problem is exceedingly difficult to solve given current data reporting systems, regardless of researcher access to data.

necessarily apply to the student on the margin of dropping out; and third, both the inputs and outputs analyzed are chosen for the ease with which they are quantified and systematically recorded over time and place, and may not map cleanly to the relevant concepts—the quality of education experienced (input) and human capital acquired (output)—even setting aggregation issues aside. To some extent, I can circumvent the first issue by considering the effects of court-ordered school finance equalizations, though the impact of such measures are mediated by political decisions regarding aggregate levels of resources for elementary and secondary education.

I define the graduation rate at the state (s) and year (t) level as the count of new graduates (excluding GED recipients) divided by the number of students enrolled in eighth grade five years earlier, as described by equation [1].

$$graduation\ rate_{s,t} = \frac{graduates_{s,t}}{eighth\ grade\ enrollment_{s,t-5}} \quad [1]$$

I begin with the general approach of Goldin and Katz’s analysis (see their Table 6.1, 2008) to correlate graduation rates, year by year, with baseline (in this case, 1963) state characteristics. Because each regression is estimated using only 48 state-level observations, I limit these characteristics to the inequality measures of interest—the 90/50 and 50/10 family income ratios, represented by *INEQ* in equation [2] below—and control additionally only for median family income and percent nonwhite, in X below. I use decennial Census data for income and race variables, which I impute for 1963, and use ACS data for 2007. I calculate these variables for families with school-aged children, as their characteristics will directly affect graduation rates. I also include regional fixed effects. Equation [2] below describes the specification.

$$y_{s,t} = \alpha_t + INEQ_s \gamma_t + X_s \delta_t + REGION_s \eta_t + \varepsilon_{s,t} \quad [2]$$

Because school quality can affect not only graduation, but also population characteristics, using fixed demographics from the baseline period helps mitigate endogeneity. The drawback is that I

estimate each year's regression on only 48 observations, and miss the variation in inequality coming from the trends in decades to follow.

Table 1 provides summary statistics of the measures used, in both 1963 and 2007. Table 2 describes the results of the ordinary least squares specification above. In Panel A, the dependent variable y is the graduation rate, and in Panel B, it is current spending per pupil. All regressions control for median family income and percent nonwhite in 1963; the estimated coefficients are not shown but are often significant and in the expected directions. Regional dummy variables are also not shown. Consistent with Figure 2, the South experienced secular gains in graduation rates while the West lost. In later decades, all regions had significantly lower levels of school spending than the Northeast, even after controlling for race and income.

Both specifications, predicting graduation and spending, yield generally noisy estimates. Panel A of Table 2 shows that the (1963) 50/10 ratio was negatively correlated with graduation rates in 1963 to a marginally statistically significant degree, but not in subsequent years; Panel B shows no statistically significant relationship between inequality at the bottom and school spending.

The considerable literature demonstrating a strong correlation between family background and graduation suggests that the 90/50 ratio is less likely to reflect the individual circumstances of students on the margin of dropping out than is the 50/10 ratio. The 90/50 ratio could still affect graduation via changes to the tax price for education faced by the median voter, as emphasized by BFWZ and CE, and via changes in school peer group composition. The estimates of the 90/50 ratio on school spending, in Panel B, quickly become quite imprecise, with confidence intervals including implausibly large positive and negative effects. The estimated relationship between the initial 90/50 ratio and graduation, in Panel A, is generally positive and statistically significant in 1990 and 2000. Given the variability of the estimates over time, I do not emphasize this result, though it is

possible that the growth of accountability programs at the state level in these decades helped students at the bottom of the achievement distribution.

I also estimate a version of equation [2] predicting changes in outcomes over the entire 1960 to 2007 period, again with the baseline characteristics as predictors. Column (7) presents those results, which are again extremely imprecise. To interpret the magnitude of the statistically insignificant point estimate, holding median income and percent nonwhite constant, a state in which the 90/50 ratio increased from 1963 to 2007 by the national average (0.49) would experience a 3.7 percentage point increase in graduation rates over the time period, exceeding the mean observed actual increase in graduation over those years. In results not shown, these estimates are essentially unchanged when including an independent variable for whether a school finance reform has been judicially mandated in a state by that year. (That variable itself is positive and statistically significant for 1990.)

I next estimate a variant of this specification, described in equation [3], pooling annual data from 1963 to 2007 (the graduation and school spending data are annual; the inequality data are imputed from the decennial Census data). This specification includes fixed effects for states and years. It differs significantly from the Goldin and Katz approach by including *concurrent* rather than baseline demographic independent variables: again median family income and percent nonwhite, with the 50/10 and 90/50 family income ratios as the inequality variables of interest. These concurrent variables allow investigation of the full scope of changes in income inequality in the latter part of the century, and also better exploit the precise timing of school finance equalizations. Because school spending and high school graduation rates can affect income inequality within a state, I emphasize the descriptive nature of these correlations.¹³

$$y_{s,t} = \alpha_t + INEQ_{s,t}\gamma + X_{s,t}\delta + \theta_s + \eta_t + \varepsilon_{s,t} \quad [3]$$

¹³ My method is analogous to the OLS method of BFWZ. They address the endogeneity issues inherent in this approach by also applying national trends in income growth to initial local income distributions, creating instruments for subsequent local inequality levels.

Unlike baseline income inequality, current income inequality is robustly correlated with both graduation and spending (as in the 1963 estimation in Table 2). Column 1 of Table 3 controls only for median family income and percent nonwhite, and reports the estimated coefficients on the 50/10 and 90/50 ratios. Applying these coefficients to the national average changes in inequality from 1963 to 2007 suggests that, all else equal, the average increase in inequality at the top correlates with a 5.5 percentage point increase in high school graduation rates (greater than the observed increase), and to a \$1,200 per pupil increase in spending (about 10 percent of the actual increase). This positive correlation with spending is consistent with the lower tax price for education spending faced by the median voter. The average increase in inequality at the bottom correlates with a 1.8 percentage point reduction in high school graduation and a \$1,070 per pupil increase in spending. There are several potential mechanisms consistent with these correlations: poor children are more costly to educate (for example, because of their disproportionate representation in special education programs); spending rises with poverty because of federal Title I funds (see Cascio and Reber, 2012); or school finance reforms or state categorical programs require more funding for poorer districts. I examine the relationship with poverty in column 3.

I next turn to analysis of court-ordered SFEs. They are correlated with a 1.4 percentage point increase in the high school graduation rate, without significantly changing the correlations between inequality and graduation. The estimated positive correlations between SFEs and graduation nearly offset the negative ones between inequality at the bottom, again applying the national average increase, and graduation. They are also correlated with about a \$330 increase in school spending per pupil. Including SFE as an independent variable changes the correlations between inequality and graduation little; the correlations between spending and inequality at the

top and bottom remain significant and positive, but are reduced somewhat by including SFEs as an independent variable.¹⁴

In column 3, I include the poverty rate. Though inequality at the bottom has increased over this period (primarily in the earlier decades) child poverty has on net fallen. As anticipated, poverty is significantly negatively correlated with graduation rates; when it is included, the negative correlation between inequality at the bottom and graduation is eliminated.¹⁵ Poverty is positively and significantly correlated with spending. It reduces the positive relationship between inequality at the bottom and spending, though that relationship remains statistically significant.

As with Altonji and Mansfield, which one could view as a micro-level analysis of these forces for two different points in time, this analysis is purely suggestive and does not support causal interpretation. State education policies and inputs likely respond to public opinion about school quality, whether actual or perceived. The income distribution in a state is determined in part by graduation rates in the state in earlier years, which could affect fertility, cross-state migration, and earnings of residents born and educated in the state.

Additional determinants of graduation rates excluded from this analysis

This limited exercise neglects to empirically examine the role of several key factors potentially changing over the time period and shown by other research to affect the acquisition of human capital. The following discussion of such omitted forces is by no means complete, and rather is meant to touch on some of the most major forces. Perhaps most critically, research in the social and life sciences increasingly recognizes the importance of early life environment and experiences in shaping human capital, including cognitive and non-cognitive skills as well as health outcomes. The now well-established fact that gaps in cognitive ability by socioeconomic status are present by

¹⁴ In analyses not shown, specifications including the interactions between SFEs and inequality yield highly imprecise estimates.

¹⁵ Using microlevel data, Kearney and Levine (2012) find support for negative impacts of inequality at the bottom on youth outcomes: conditional on individual poverty status, inequality in a state is positively correlated with teen childbearing.

the time children enter kindergarten (Duncan and Magnuson, 2011) confirms that attempting to analyze variation in high school graduation solely as a factor of elementary and secondary education policies is necessarily limited, and suggests the potential for many policies to ultimately affect educational attainment. These could include policies affecting maternal exposure to a variety of environmental toxins and licit and illicit drugs (Currie, 2011), pre- and post-natal nutrition (Almond, Hoynes, and Schanzenbach, 2011), and the quality of childcare environments prior to enrollment in elementary school, including the home environment (Phillips, 2011).

V. CONCLUSION

The descriptive results presented raise an interesting question. If, as these results suggest (and CE and BFWZ show convincingly), the inequality in recent decades led to increased school spending, would a better-identified setting (e.g., one with exogenous changes in inequality) show a positive relationship between inequality and student outcomes? If so, would the benefits of inequality-induced additional resources reach students throughout the achievement distribution? There could be a positive impact of these funds on graduation rates, but one that is more than offset by other mechanisms through which inequality negatively affects attainment. Alternatively, little to none of the increases in spending at the district level may be making their way to those students on the margin of dropping out of high school, due to the non-uniform allocation of resources across schools within districts and within individual schools.

Research on school quality has been moving towards the more productive exercise of assessing returns to specific inputs, as opposed to dollars spent per pupil. As researchers have shown convincing correlations between specific inputs and educational outcomes, public policy has begun to embrace these findings. For example, consider the extent to which Race to the Top rewards the use of specific technologies in educational production, including those enabling the identification of teacher-specific contributions to achievement. Yet the role for policy is still limited

as the most compelling input to school quality identified to date—teacher quality—has been identified essentially as a residual and it is not clear how policies can manipulate its level or distribution. Research into the production of *teacher* quality is an important next frontier for this literature. As recent efforts of the National Council on Teacher Quality reveal, this is a politically fraught endeavor, facing major resistance from schools of education and teachers' unions.

Another fruitful avenue for future research on education production functions is to consider the regulatory environments in which resources are allocated, at the state, district, and school levels. Regulation of federal Title I funds increased—both in terms of formal requirements and actual enforcement—in response to early reports of malfeasance (see Martin and McClure, 1969), and other categorical programs, from federal and state sources, have followed suit with their own requirements. The initial push for greater regulation came about in response to a large volume of reports of school districts using federal funds to maintain a desired unequal distribution of total resources. The regulatory environment today has evolved such that critics fear it poses serious difficulties for districts genuinely attempting to equalize the quality of education across their schools (for detailed descriptions of particular regulations, see Junge and Krvaric, 2011; for discussion of the opaque and non-uniform allocation of resources within districts, see Roza, 2010). This allocation poses difficulties for researchers as well, who regularly implicitly view reported revenues and expenditures at the school district level as predictive of student-level resources throughout the district.

The world of quantitative research in education has changed dramatically in the last decade. No Child Left Behind brought with it a push for “scientifically-based research” emphasizing exogenous variation in educational inputs and large, quantitative datasets. Ideally this new orientation can be merged productively with careful attention to institutional detail, allowing for the creation of accessible data on the most relevant variables, to produce the research necessary to guide investments in future generations of human capital.

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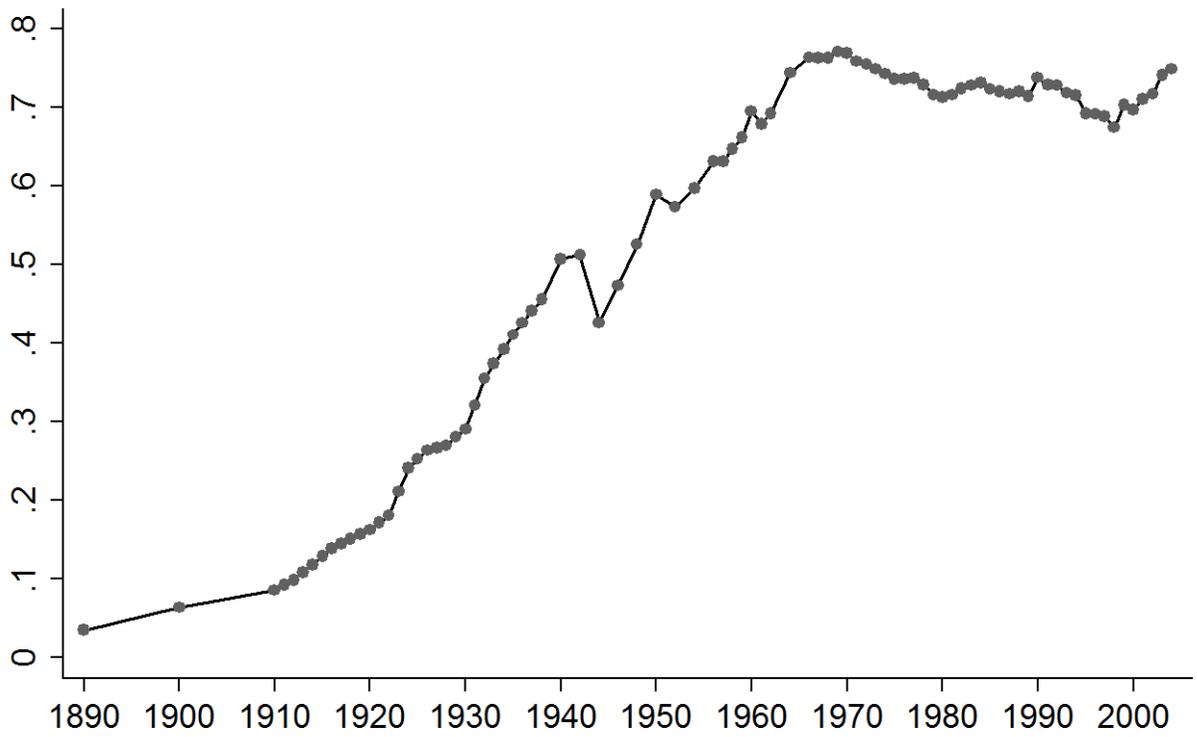
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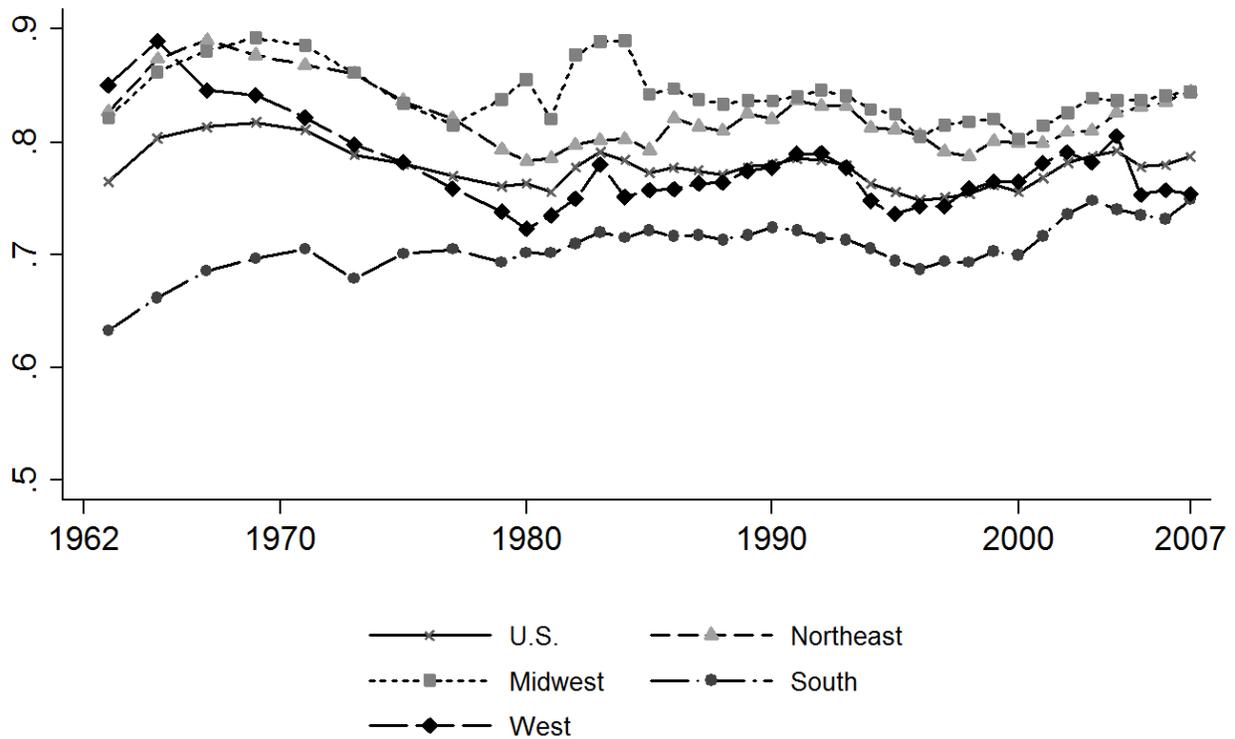
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Figure 1. U.S. High School Graduation Rates, 1890-2004



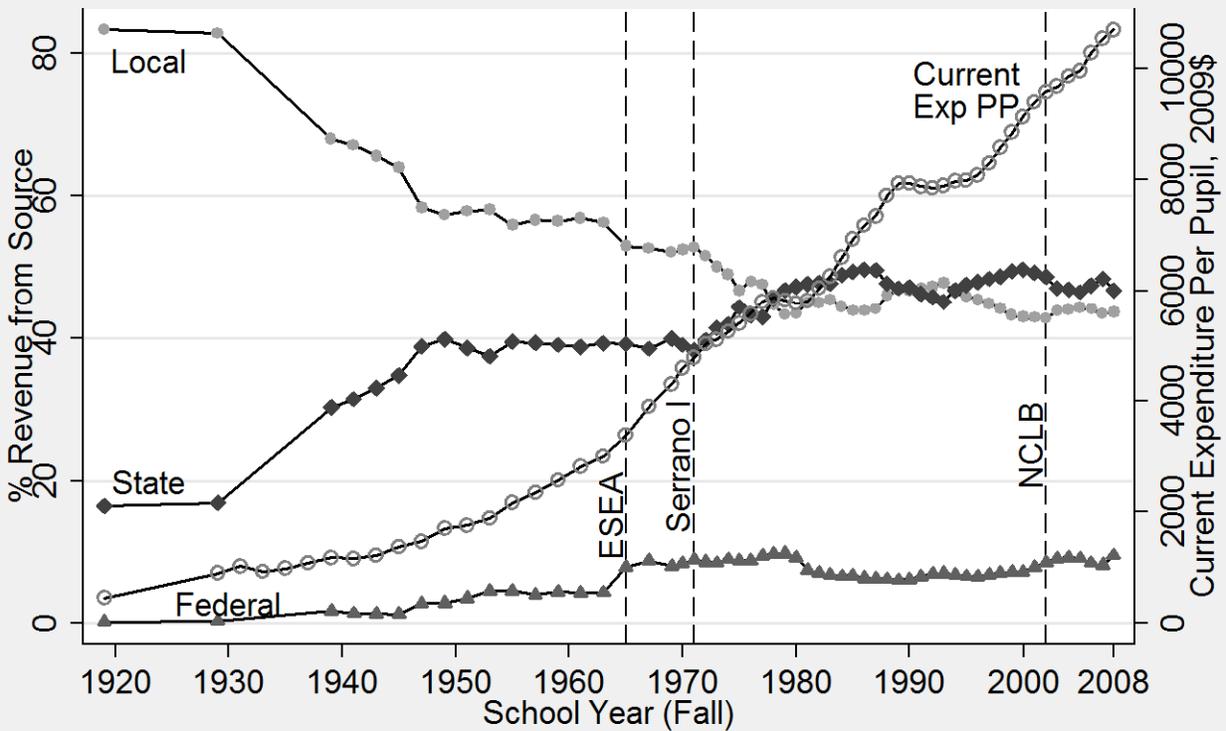
Source: Goldin and Katz (2008), Figure 9.2.

Figure 2. High School Graduation Rates by Region



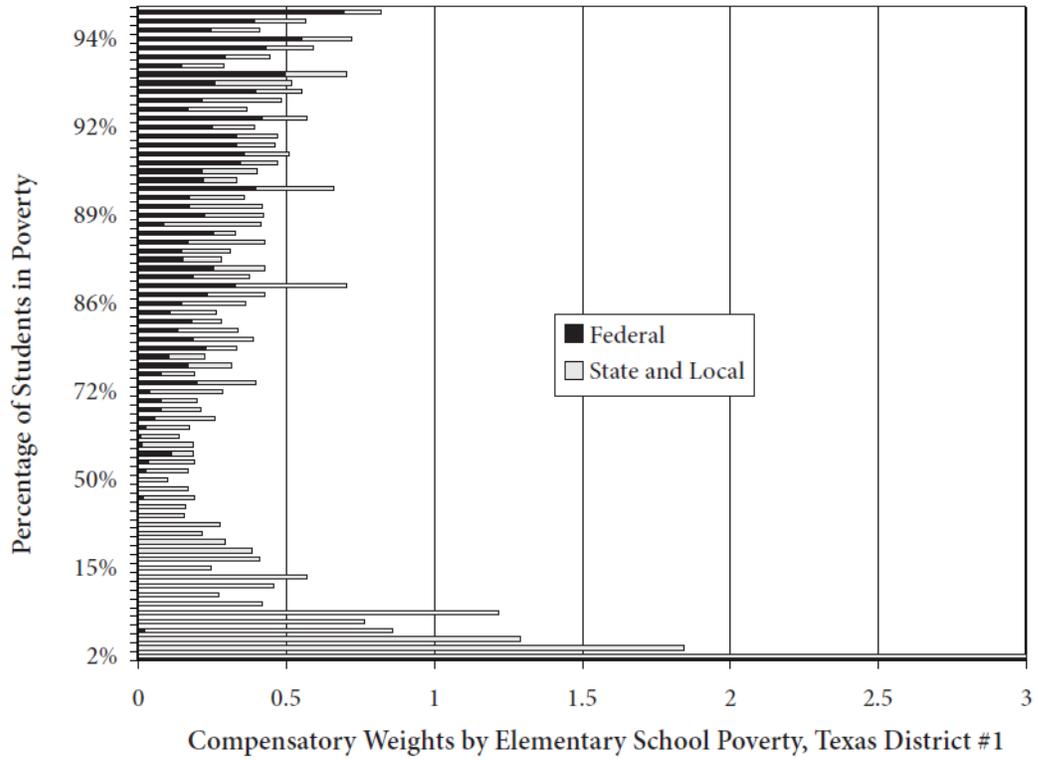
Notes: Graduation rates are calculated as the count of graduates (excluding GEDs where possible) divided by eighth grade enrollment five years previously. Graduate and enrollment by grade data are from state educational agencies (as reported in Statistics of State School Systems and Digests of Education, various years).

Figure 3. Trends in Spending Per Pupil and the Share of Education Revenue from Local, State and Federal Sources, 1919-2008



Notes: Spending and revenue data from NCES Digests of Education, various years.

Figure 4
 Allocation of revenue, by source, across schools within anonymous Texas district



Source: CRPE School Finance Redesign Project. Roza, Guin and Davis, 2008. Data are from 2003-04 school year.

Table 1. Descriptive Statistics.

	Panel A. Weighted by School-aged Population.			
	1963		2007	
	mean	s.d.	mean	s.d.
High school graduation rate	0.767	0.115	0.789	0.070
Current spending per pupil (thousands of 2009\$)	0.465	0.116	11.069	2.806
90/50 family income ratio	1.979	0.168	2.551	0.234
50/10 family income ratio	2.989	0.83	4.074	0.454
Median family income	45,881	8,314	59,957	9,063
Percent school-aged children nonwhite	13.69	11.32	30.08	10.52
Percent school-aged children in poverty	22.81	11.72	16.88	3.57

	Panel B. Unweighted.			
	1963		2007	
	mean	s.d.	mean	s.d.
High school graduation rate	0.740	0.107	0.789	0.082
Current spending per pupil (thousands of 2009\$)	0.436	0.096	11.004	2.581
90/50 family income ratio	1.989	0.184	2.476	0.481
50/10 family income ratio	3.067	0.879	4.000	0.791
Median family income	44,586	8,454	59,988	10,603
Percent school-aged children nonwhite	14.57	16.8	27.26	15.66
Percent school-aged children in poverty	24.47	11.76	16.11	4.55

Notes: Income, poverty, and race data are from decennial Censuses (Ruggles et al.), linearly interpolated between years. School finance equalizations (SFEs) are from Corcoran and Evans (2008). Graduation rates are calculated as the count of graduates (excluding GEDs where possible) divided by eighth grade enrollment five years previously. Spending, graduate and enrollment by grade data are from state educational agencies (as reported in Statistics of State School Systems and Digests of Education, various years).

Table 2. Relationship between Statewide Income Inequality in 1963 and Subsequent Education Indicators.

Panel A. Dependent Variable: High School Graduation Rate.							
	Levels						Change 1963 to 2007
	1963	1971	1980	1990	2000	2007	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
50/10 ratio in 1963	-0.0410*	-0.0361	0.00139	-0.00869	-0.0197	-0.0328	0.0205
	(0.0221)	(0.0228)	(0.0212)	(0.0142)	(0.0202)	(0.0199)	(0.0208)
90/50 ratio in 1963	0.108	0.0425	-0.0366	0.123**	0.140**	0.0197	0.077
	(0.0782)	(0.0863)	(0.0945)	(0.0545)	(0.0683)	(0.0790)	(0.0719)
R-squared	0.711	0.754	0.601	0.688	0.6	0.601	0.553

Panel B. Dependent Variable: Current Elementary and Secondary Spending per Pupil (in 1000s of 2009\$).							
	Levels						Change 1963 to 2007
	1963	1971	1980	1990	2000	2007	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
50/10 ratio in 1963	0.0236	0.00569	0.0502	0.108	0.182	0.49	0.0747
	(0.0207)	(0.0543)	(0.1230)	(0.2670)	(0.3490)	(0.4730)	(0.5230)
90/50 ratio in 1963	0.164*	0.204	0.698	1.178	0.107	2.845	-0.428
	(0.0886)	(0.2310)	(0.5710)	(1.0760)	(1.7140)	(2.6660)	(1.8990)
R-squared	0.756	0.624	0.565	0.766	0.726	0.695	0.68

Notes: All regressions include dummy variables for Midwest, South, and West regions and control for initial (1963) median family income and percent nonwhite. Each regression is estimated with 48 observations (the lower 48 states). Income, poverty, and race data are from decennial Censuses (Ruggles et al.), linearly interpolated between years. School finance equalizations (SFEs) are from Corcoran and Evans (2008). Graduation rates are calculated as the count of graduates (excluding GEDs where possible) divided by eighth grade enrollment five years previously. Spending, graduate and enrollment by grade data are from state educational agencies (as reported in Statistics of State School Systems and Digests of Education, various years).

Table 3. Relationship between Current Statewide Income Inequality and Education Indicators.

Panel A. Dependent Variable: High School Graduation Rate.			
	(1)	(2)	(3)
50/10 ratio	-0.0167*** (0.0039)	-0.0173*** (0.0039)	0.0058 (0.0040)
90/50 ratio	0.0973*** (0.0193)	0.0970*** (0.0191)	0.0751*** (0.0181)
SFE		0.0142*** (0.0035)	0.0184*** (0.0033)
%poor			-0.0058*** (0.0005)
R-squared	0.822	0.824	0.835

Panel B. Dependent Variable: Current Elementary and Secondary Spending per Pupil (in 1000s of 2009\$).			
	(1)	(2)	(3)
50/10 ratio	0.9909*** (0.0691)	0.9612*** (0.0690)	0.6224*** (0.1050)
90/50 ratio	2.1028*** (0.3616)	1.8251*** (0.3398)	1.7578*** (0.3427)
SFE		0.3273*** (0.0761)	0.3158*** (0.0766)
%poor			0.0675*** (0.0129)
R-squared	0.967	0.968	0.969

Notes: All regressions include state and year dummy variables. Income, poverty, and race data are from decennial Censuses (Ruggles et al.), linearly interpolated between years. School finance equalizations (SFEs) are from Corcoran and Evans (2008). Graduation rates are calculated as the count of graduates (excluding GEDs where possible) divided by eighth grade enrollment five years previously. Spending, graduate and enrollment by grade data are from state educational agencies (as reported in Statistics of State School Systems and Digests of Education, various years).