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THE LENGTHENING OF CHILDHOOD

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ABSTRACT

Forty years ago, 96% of six-year-old children were enrolled in first grade or above. As of 2005, the figure was just 84%. The school attendance rate of six-year-olds has not decreased; rather, they are increasingly likely to be enrolled in kindergarten rather than first grade. This paper documents this historical shift. We show that only about a quarter of the change can be proximately explained by changes in school entry laws; the rest reflects "academic redshirting," the practice of enrolling a child in a grade lower than the one for which he is eligible. We show that the decreased grade attainment of six-year-olds reverberates well beyond the kindergarten classroom. Recent stagnation in the high school and college completion rates of young people is partly explained by their later start in primary school. The relatively late start of boys in primary school explains a small but significant portion of the rising gender gaps in high school graduation and college completion. Increases in the age of legal school entry intensify socioeconomic differences in educational attainment, since lower-income children are at greater risk of dropping out of school when they reach the legal age of school exit.

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Over the past 40 years, the age at which children enter first grade has slowly drifted upward. In the fall of 1968, 96 percent of six-year-old children were enrolled in first grade or above. By 2005, the proportion had dropped to 84 percent (Figure 1, panel A, the lower line). The school attendance rate of these young children had not declined (top line of panel A); it has held steady at nearly 100 percent for decades. But while in 1968 nearly all enrolled six-year-olds were in first grade, today a substantial share is instead in kindergarten. A similar pattern can be seen among seven-year-olds (not shown), with an increasing share enrolled in first grade rather than second grade.

About a third of the increase in age at school entry can be explained by legal changes, as we will show. Almost every state has increased the age at which children are allowed to start primary school. This change is remarkable given the strong evidence that, in the United States, starting school later *de*creases educational attainment. The other two-thirds of the increase in the age at school entry reflects the individual decisions of parents and teachers who choose to keep children out of kindergarten or first grade even when they are legally eligible to attend. This practice is sometimes called "red-shirting," a phrase originally used to describe the practice of holding college athletes out of play until they have grown larger and stronger.

Red-shirting is referred to as "the gift of time" in education circles, reflecting a perception that children who have been allowed to mature for another year will benefit more from their schooling. As we will discuss, little evidence supports this perception. It is indeed true that in any grade, older children tend to perform better academically than the younger children. Natural variation in birthdays produces age differences among classmates of up to twelve months. Among young children, even a few months' difference in age can lead to substantial differences in cognitive and emotional development. It is therefore unsurprising that in the early grades there is a strong, positive relationship between a child's age in months and his performance relative to his peers. But there is little evidence that being older than your classmates has any long-term, positive effect on adult outcomes such as IQ, earnings, or educational attainment. By contrast, there is substantial evidence that entering school later reduces educational attainment (by increasing high school dropout rates) and depresses lifetime earnings (by delaying entry into the labor market).

Boys are more commonly red-shirted than girls (see Figure 1, panel B). Sex differences can't be attributed to variation in school entry laws, indicating that parental and teacher decisions

are playing a role in the declining grade attainment of these children. Upper-income, white, highly-educated parents red-shirt their children at the highest rate. News coverage of this trend suggests these parents are focused not on their child's age, but on the age of their classmates: red-shirting parents do not want their children to be among the youngest in the classroom. Parents believe that older children out-compete their younger peers in the classroom, on the athletic field, and in college admissions. Thus, eager to give their children an edge, parents are willing to hold back their child one year in order to shift them up the pecking order (Weil, 2007).

Academic red-shirting manifests itself when kindergarten-eligible children enroll in prekindergarten. It also manifests itself in kindergarten repetition, which has been formalized in some school districts as "junior first grade," the "readiness room," or the "transition room." While the label and mechanism vary, the end is the same: children enter first grade—the historical entry point for primary schooling—at a later age. Children who enter school a year later reach the rest of life's milestones later. Since the transition from preschool to elementary school now occurs later in life, so too does the transition from high school to college and from college to the full-time labor force. In the late 1960s, 6–7 percent of 17 year-olds were enrolled in college; now, the figure is 2–3 percent. The share of 17 year-olds in 12th grade or above dropped from 68 percent in 1968 to 63 percent in 2005. The recent stagnation in the high school and college completion rates of those in their late teens and early twenties (especially males) is partly explained by their later start in primary school, as we will show. Recent cohorts also marry later (Stevenson and Wolfers, 2007).

Combining these patterns, adulthood arrives later in life than it once did: childhood is lengthening. Historically, the boundaries of childhood have ebbed and flowed. Social historians and sociologists date the concept of childhood as a unique stage in life to the early nineteenth century (Ariès, 1962). The concept of adolescence arrived even later, at the end of the nineteenth century (Kett, 2003). Ariès argues that when life was short, there was no time for an extended childhood or adolescence. The fluidity of childhood's boundaries is visible today in debates over the age at which people can legally drop out of school, drive, vote, work, drink alcohol, and engage in consensual sex.

Academic researchers have examined delays in each of these transitions, but have done so in unconnected disciplinary and topical silos. Developmental psychologists and other academics who focus on young children have debated the effect of delayed school entry on the

academic performance of young children (Graue and DiPerna, 2000; Stipek, 2002). Labor economists and other academics who focus on young workers have debated explanations for the delayed transition to the labor force and marriage. The Macarthur Network on Transitions to Adulthood has produced extensive research on this topic (for example, Danziger and Rouse, 2007).

There are costs to the "graying of kindergarten" (Bracey, 1989), and some of these costs arrive decades after preschool. There is strong evidence that when the age of school entry rises, so do high school dropout rates. Many teenagers leave school as soon as the law will let them. Teenagers who leave school as soon as they are legally able (say, at age 17) will end up with more years of schooling if they entered first grade at age six than if they entered at age seven. High school graduation rates in the United States are stagnant or falling (Heckman and LaFontaine, 2007), and the United States is falling behind other nations in its rate of human capital accumulation (OECD, 2004). Factors that decrease the educational attainment of young people should not be taken lightly.

Most late entrants will not drop out but will complete their educations and enter the labor force a year later. Decreased labor force participation among millions of young workers is salient to current debates regarding Social Security finance. The retirement of the baby boom coupled with decreased fertility rates is producing a sharp increase in the dependency ratio (the proportion of nonworkers to workers). Increases in the dependency ratio tend to increase demands on government services for things like schooling and health care, and to reduce revenue for programs funded by taxes on labor earnings, most prominently Social Security and Medicare. Considering the volume of economic analysis and political debate that surrounds contemplated changes of a year or two in the Social Security retirement age, economists should pay attention to rising age at school entry and its implications for public finance.

Documenting the Graying of Kindergarten

While children enter first grade later than they once did, they are not staying at home. They are enrolled in kindergarten or prekindergarten. The top line of Figure 2 plots the share of five-year-olds enrolled in school, which rose steeply through the mid 1970s. This upward trend reflects the diffusion of publicly provided kindergarten throughout the United States; the states in

the South were the last to join the trend. Through the mid 1970s, all of the growth in the enrollment of five-year-olds is explained by increases in their kindergarten enrollment; the two track each other closely (Figure 2). But beginning in the 1980s, the kindergarten enrollment rate of five-year-olds began to drop. These children were enrolled in school, but at a level below kindergarten—public prekindergarten or privately provided preschool.

We next examine how much of the downward trend in the grade attainment of six-year-olds can be explained by changes in laws. As documented by Bedard and Dhuey (2007), among others, many states have increased the age at which children can enter school. The average cutoff date by which a child must have turned five in order to enter school in September of a given year has moved earlier in the year, though the cumulative change is relatively small: the (population-weighted) mean has moved from November 25 to October 14, or by six weeks (Figure 3, top panel).[1] Most of this change happened between about 1970 and 1990. The children mechanically affected by these legal changes have a birthday that falls between the old and new cutoffs. The typical state law change shifts the entry cutoff back by a month or two, thereby directly affecting one-twelfth to one-sixth of children in the state.

We use these legal changes to simulate the October enrollment rates of six-year-olds, *assuming that all children enter school as soon as they are eligible*.[2] The predicted enrollment rate is plotted in the top line in the bottom panel of Figure 3. Each state is weighted by its average population of five-year-olds over the 1977 to 2005 period. Roughly one-quarter of the decline in grade attainment of six-year-olds is explained by changes in state entry laws.

Thus, about three-quarters of the drop over time in grade attainment of six-year-olds is a function not of state law but of decisions made by parents, teachers, and school districts. Those who red-shirt tend to be a socioeconomically advantaged group. Using regression-discontinuity methodology, Dobkin and Ferreira (2007) compare the characteristics of kindergarten-eligible children who enroll in kindergarten ("compliers") vs. those who delay ("redshirters"). In California, the compliers have parents with significantly lower education levels (8.9 years vs.

[1] Kelly Bedard kindly shared her records on school entry laws, allowing us to generate this figure and subsequent analysis.

[2] To simplify the calculation, we assume a uniform distribution of births across the year. Births have been shifting from the last two quarters of the year into the first two quarters (decennial censuses, results available upon request), especially in southern states. This trend means that children are increasingly *less* likely to be born in the months affected by the shifting in entry laws (July through December). This further decreases the "bite" of the legal changes. Our one-quarter calculation is therefore an upper bound on the proportion of the increase in age at school entry that can be explained by laws, as opposed to red-shirting.

10.6 years) and are more likely to be black or Hispanic (59 percent vs. 33 percent). The incomes of complying parents are 40 percent lower than those of redshirters. The pattern is the same in Texas, with the differences only slightly smaller

Puzzles Explained by Rising Age at School Entry

Later entry to first grade leads to a number of downstream outcomes, including effects on "grade retention" (holding a student in the same grade for an extra year), high school completion, and BA completion. Indeed, delays in school entry help to explain a number of puzzles in education.

Grade Progression and Grade Retention

An outcome of interest in economic and education research is whether children are enrolled in their "expected grade." The expected grade is traditionally calculated as age minus five, so that a six-year-old is expected to be in first grade. Being below one's expected grade is typically interpreted as a proxy for grade retention. As one example among many, Shepard and Smith (1989, p. 6) write: "Despite its salience, rates of promotion and retention are not kept by government agencies. Instead retention rates must be inferred from the proportion of pupils of a given age who are not in the appropriate (or modal) grade." We now show that much of the variation in age-for-grade over time is driven not by retention and promotion policies, but rather by the age at which children enter first grade.

Figure 4 plots the share of children enrolled in at least their expected grade from age six through age twelve for cohorts born in the early 1960s (1962–64), the early 1970s (1972–74), and the early 1980s (1982–84). The intercept of each line indicates the share of each cohort entering first grade by age six. The slope of each line indicates the share of children retained in a grade between age six and age twelve. First look just at the 1962–64 and 1982–84 cohorts. For these two groups, the intercepts are ten percentage points apart, indicating that the later birth cohort is ten percentage points less likely than the earlier cohort to be on time at age six. The same holds at age twelve. The two lines are parallel, indicating that grade *retention* was essentially identical for these two birth cohorts.

For those born in the early 1970s, by contrast, grade retention played a substantial role in determining age-for-grade. The share of this cohort behind grade by age twelve was about 0.30—about the same as that for the 1980s cohort. But the two cohorts ended up at the same place by very different routes, with children born in the 1980s entering later but being retained (held back) at a lower rate. Clearly, age-for-grade is a highly imperfect proxy for grade retention.[3]

Accounting for variation in age at school entry substantially alters much-commented-upon trends in the grade progression of students. In Figure 5, the lowest line plots the share of nine-year-olds who are in fourth grade or above, from 1971 through 2005. There is a pronounced decline in this measure from the mid 1970s (83 percent) through the late 1980s (73 percent); the series then dips and rises with no overall trend through to the present. Much of this variation in the grade attainment of nine-year-olds is attributable to the age at which these children started first grade. If we hold constant the grade attainment of birth cohorts as of age six, the variation is substantially muted, as shown in the top line.[4] We find the same pattern when we examine the time series in the share of 13 year-olds in expected grade. Much of the variation over time in the grade attainment of these children is therefore a product not of changes in pedagogy, educational inputs, or retention policy, but of historical variation in their age at first-grade entry.

Stagnating Educational Attainment

Rising age at school entry affects our interpretation of time-series data that focus on educational attainment at a given age. For example, a report from the U.S. Department of Education (2007) states: "Between 1970 and 2005, enrollment rates increased . . . for adults ages 18–34, who are typically in postsecondary education. Youth ages 18–19 experienced the largest overall increase in enrollment during this period, from 48 to 68 percent. The overall enrollment rate for 2005 was up from 61 percent of students in this age group in 2000."

[3] Cascio (2005) comes to the same conclusion using a different approach. She examines the relationship between age-for-grade and parent-reported grade retention, which was provided in the 1992 and 1995 October Current Population Survey, and also finds that age-for-grade is a poor proxy for grade retention.

[4] To generate this adjusted series, we regress the share in expected grade at age nine against the share in expected grade at age six and plot the residuals (normed to the actual mean in 1971). The regression is conducted at the level of cell means, weighted by cell size. These cells are defined by the interaction of sex, race, (proxied) year of birth, and nine census divisions for a total of 1,260 (2 x 2 x 35 x 9) cell means. We proxy for year of birth with survey year minus age. Adding fixed effects at the level of race, sex, census division, and their two-way interactions does not alter the adjusted series.

Historically, until the mid 1980s, changes in the school enrollment rate of 18–19 year-olds were driven completely by changes in the *college* enrollment rate. As shown in Figure 6, panel A, the college enrollment rate and the overall enrollment rates for this age group dipped sharply together in the early 1970s, as the threat of the Vietnam draft was lifted and returns to schooling reached their nadir (Card and Lemieux, 2001; Freeman, 1976). The two series rose slowly together in the next decade, as returns to schooling began to increase.

But starting in the mid 1980s, college enrollment stagnated while school enrollment continued to rise. The high school enrollment rate for 18–19 year-olds, which held steady at roughly 10 percent during the 1970s, rose to 18 percent by 2005. This downshifting of the grade attainment of 18–19 year-olds is a male, white, and Asian phenomenon. Among blacks and Hispanics, high school attendance has held steady; all of their growth in school enrollment reflects increased college enrollment. Among women, the growth in school enrollment for 18–19 year-olds rose from 46 percent in 1980 to 69 percent by 2005 is also overwhelmingly driven by college enrollment.

This aging of high school students affects our interpretation of changes over time in high school completion. Eighteen is the age at which analysts traditionally measure high school graduation, but a child who starts first grade at age seven will still be enrolled in high school at age 18 unless that child skips a grade or drops out. Rising age at school entry therefore explains part of the recent decline and stagnation in high school completion of 18 year-olds, which is shown by the bottom line in the bottom panel of Figure 6. Again, we hold constant the year at which students start school, using the same regression adjustment as for the previous figure.[5] Both the adjusted and unadjusted series show a decline in the late 1980s, but then the series that adjusts for age at school entry flattens out, as shown by the top line, while the unadjusted series continues to decline. Since 1990, the "decline" in the high school completion of 18 year-olds reflects the fact that these adolescents started first grade late and so could not complete high school by 18. The interpretation of this as a delay is supported by a similar plot for 19 year-olds (not shown): much of the decline is eliminated, and the adjusted and unadjusted series are essentially identical.

[5] Note that in the historical Current Population Survey data we cannot distinguish between a traditional high school degree and GED (General Education Development) certification.

A similar pattern holds for BA completion, traditionally measured at age 22 (Figure 7). While the unadjusted series is essentially flat from 1982 to 2005, the adjusted series shows a slight increase. Again, it appears that this reflects delayed attainment, since the series measured at age 23 is insensitive to this adjustment (not shown). Both the BA and high school figures demonstrate that historical time series in the educational attainment of young adults are influenced by changes across time in age at school entry. This caution is important, given the frequency with which these time series are used to infer causal relationships between public policy and educational attainment.

Sex Differences in Educational Attainment

Sex differences in age at school entry partially explain the rising gap in the high school completion of males and females. Figure 8, panel A, plots the sex difference in the high school completion rate of 18 year-olds. The female advantage was about ten percentage points for decades but began to rise in the early 1990s and now stands at 15 percentage points.
Once we adjust for differing ages at school entry, the increase in the gap is reduced by about a fourth. Again, if one looks instead at 19 year-olds, who have had time to finish high school even if they entered first grade later, the male–female gap in high school graduation rates is lower and there is no upward trend over time.

These sex differences can be tracked yet another step to the completion of a bachelor's degree. The sex difference in BA completion of 22 year-olds has been fitfully rising for over 20 years (Figure 8, panel B). Women in this age group are about seven percentage points more likely than men to hold a BA degree, up from two percentage points in 1984. If we adjust for sex differences in age at first-grade entry, today's difference is attenuated by about one point. Further, the time pattern differs for the adjusted and raw series. In the adjusted series, there is no steady growth in the gap until the late 1990s; until then, growth in the sex gap in BA attainment is an artifact of sex differences in the age of first-grade entry. This distinction is critical for both academic researchers searching for explanations for the gap and policymakers trying to close it. Until quite recently, growth in the sex gap in BA attainment is attributable not to the decisions of adolescents on the cusp of college, but rather to the decisions of parents and teachers 16 years earlier.

Explanations for Rising Age at School Entry

Increasingly Academic Curriculum in Kindergarten

What are the leading candidate explanations for rising age at school entry?[6] One plausible explanation for the trends documented so far is that kindergarten is today what first grade was 40 years ago, and so most children—those who do not delay entrance to kindergarten—are actually beginning the substance of their formal educations one year *earlier*. In this scenario, the main story is not aging first-graders but increasing standards in kindergarten. This hypothesis is worth systematic investigation, and none has yet occurred. A number of papers have criticized a perceived shift toward an academic curriculum in kindergarten (for example, Shepard and Smith, 1988). A nationally representative time series of standardized test scores for entering and exiting first-graders would tell us whether children now enter first grade better prepared and learn more when they are there, which would be consistent with kindergarten today being what first grade was 40 years ago. Such a time series does not exist. A systematic review of changes over time in curricula, standards, and lesson plans for kindergarten and first grade would also be informative. We have found no such review. Thus, the evidence that the schooling of these very young students has grown more academic is primarily anecdotal at this stage.

We conducted our own case study using curricular standards from the state of Georgia, which were available online. Georgia's current standards for kindergarten do appear more rigorous than they were 25 years ago and contain some elements of the standards once applied to first grade. This case study is suggestive but not dispositive; it is quite likely that the states that best document their standards are the states that are increasing their standards, so our case study may provide a biased portrait of national trends.

Is kindergarten the new first grade? If so, we would expect to see a return to this additional year of schooling in terms of academic performance in later grades and, ultimately, labor market outcomes. The idea that kindergarten is the new first grade would imply that eighth grade is the new ninth grade and twelfth grade the new freshman year of college. Perhaps such a change is occurring at the upper end of the income distribution. In upper-income schools, high

[6] Along with Brian Jacob, we are now undertaking an empirical investigation of the relative explanatory power of each of the factors discussed in this section.

school students are more likely today to take Advanced Placement courses than they were 15 years ago (College Board, 2005). There is no evidence, however, that such advances are occurring at the lower tail. Test scores provide no support for the hypothesis that nine-year-olds and 13 year-olds are more academically prepared than they were in the past. The share of 17 year-old students performing at a basic level of proficiency on the National Assessment of Educational Progress (NAEP) has not risen at a rate that would suggest the majority of students are learning at a grade level higher than they were 20 years ago.

Accountability and High-Stakes Testing

Accountability programs and high-stakes testing are frequently blamed as a driver of increasing age at school entry (Weil, 2007; Stipek, 2002; Lincove and Painter, 2006). The hypothesis is that testing in third grade leads principals and teachers to set a higher bar at kindergarten and first grade. However, age at entry began to increase at least a decade before the rise of high-stakes testing in the 1980s (as shown in Figure 1). The acceleration of this trend in the 1980s and 1990s may be attributable to the introduction of high-stakes testing, however, and this hypothesis bears investigation.

At least some of the recent changes in legal age at school entry seem to have been driven by concerns about performance on standardized tests. The sponsor of a North Carolina bill to increase the school entry age noted (as quoted in Weil, 2007): “Our kids are younger when they’re taking the SAT, and they’re applying to the same colleges as the kids from Florida and Georgia.” When California raised its entry age, the legislation cited the fact that the state’s children were younger than those in other states in the same grade (cited in Stipek, 2002) and so were at a disadvantage in testing. Thus, states may be engaging in a “kindergarten arms race,” with children starting school at an ever-increasing age in order to gain a perceived advantage on standardized tests.

Red-shirting may be an unintended consequence of greater school accountability. Those who decide when a child will start school—kindergarten teachers, elementary school principals, young parents—are focused on the short-term benefits that delay can offer. Principals and teachers care about the welfare of their young students, and increasingly they are held accountable for their test scores. They are not held accountable for reduced labor force

participation or increased dropout rates; in fact, they do not typically even observe these outcomes.

Competition between Parents

Red-shirting parents appear to believe that relative age matters for children's performance. There is no evidence of a lasting benefit to education or earnings from being older than one's classmates. There is, however, evidence of a lasting competitive advantage in sports. In Europe and the United States, children on elite youth soccer, hockey, swimming, and tennis teams are disproportionately born just after the age cutoff for those leagues—that is, they are the oldest of their peers. This early advantage persists, with 60 percent more Major League Baseball players born in August than in July, mirroring the near-universal age cutoff of July 31 in youth baseball. Spira (2008) discusses this literature, but see also Glamser and Vincent (2004), Barnsley, Thompson, and Barnsley (1985), Barnsley and Thompson (1988), and Musch and Grondin (2001). Relative age effects could plausibly persist in other tournament settings. Admission to the most elite colleges is a rank-order tournament, for example. We are exploring whether age effects persist in this competitive arena.

Note that rank-order age effects are (at best) a zero-sum phenomenon. When one child moves up the classroom age rank, another moves down. Whatever their effect on individual outcomes, changes in relative age cannot increase social welfare. In fact, by allowing (or encouraging) parents to manipulate the age rank of their child in the classroom, schools may set off a cycle of social pressures that steadily pushes up the age of children at school entry, to the detriment of social welfare. The presence of older, more mature children in a class may lead teachers to raise their standards, resulting in lower relative performance and increased grade retention rates for children who enter school at the statutory age. These increasing standards could, in turn, lead school districts to raise their statutory or recommended age at school entry to ready children for the increased classroom rigor. And as the age of school entry rises, another round of parents will be induced to red-shirt their children so that they can maintain their rank in the classroom age distribution. This dynamic would be self-reinforcing, with parents always seeking to have their children be oldest in the class, relative standards rising, age of the entire class rising, and a yet-older set of children red-shirted.

In this sort of unraveling game, government can increase social welfare by constraining private decisions. One solution would be to set a single age at which children both can and must enter school. This is the approach taken in Norway, where students start school the year they turn seven and any exceptions are granted only upon a formal request and justification (Black, Devereaux, and Salvanes, 2008).

Childhood as a Normal Good

One explanation for delayed school entry is that parents obtain utility from keeping their child out of primary school for an additional year. As incomes rise, and if childhood is a normal good, parents may choose to purchase an additional year of childhood. The demographic patterns of red-shirting are consistent with this explanation, with higher-income, better-educated parents more likely to hold their children back. Given the rise in preschool enrollment of three- and four-year-olds and sharp increases in maternal employment, however, the desire for *time* with one's young children is not the explanation. Still, parents may view the start of formal schooling as a symbolic transition out of childhood and so choose to delay it if they can afford to do so. They may fund this delay individually, by paying for private preschool, or socially, by voting for free, public prekindergartens.

Costs and Benefits of Increasing Age at School Entry

It may be that delayed schooling is a productive investment, and parents, teachers, and policymakers are making rational choices. When would delay be productive? In the classical human capital model, education is an investment that produces returns over the lifetime. Increasing the age at which children start school is efficient only if the (discounted) benefits of this delay at least equal its (discounted) costs. In this section, we start with a brief, theoretical overview of these costs and benefits and then move to assessing the empirical evidence on these questions. In theory, the welfare calculation is conceptually straightforward. But the empirical evidence in this area is incomplete, and more research is needed to get a firmer grasp on the welfare implications of increasing age at school entry.

Costs and Benefits of Increasing Age at School Entry: Theory

We start with the possible benefit of delaying school entry. Consider a setting in which adolescents cannot quit school until they have completed a certain number of years (as in most of Europe); this simplifies the analysis. Given (say) ten years of compulsory schooling, does more learning occur if school starts at age seven than if it starts at age six? We can think of reasons why this would be true. A more mature child may have a greater capacity to learn, building more human capital for each year in school; that is, the more mature child may learn more efficiently. This idea lies behind many educators' positive views toward red-shirting and corresponds to the "maturationist" model of development psychology. If the maturationist model is correct, then the secular increase in age at school entry will make each year of schooling more effective in generating human capital. An alternative model is the "experientialist" perspective, in which children learn to learn by interacting with others and through new experiences. If the experientialist model is correct, then delaying school delays learning and produces no social or private benefits.

Now we consider the theoretical costs of delaying school entry. Holding constant retirement age, a person who starts school a year later spends one less year in the labor force. The financial losses from starting one year later consist of one year of labor market earnings, as well as the lifetime return to that lost year of labor market experience. In our simplified setting, then, the cost–benefit calculation weighs the loss of a year of labor market earnings and experience against any additional human capital acquired due to later school entry.

Finally, we modify this setting slightly. In the United States, compulsory schooling laws constrain children to remain in school not for a given number of *years* but until a given *age*. Child labor laws, which reduce the opportunity cost of schooling by restricting the ability of children to earn money, are also defined based on age. Therefore, the calendar age of students is what constrains their schooling decisions: the *younger* a student at school entry, the *more schooling* that student is constrained to obtain. In the United States, then, the cost–benefit calculation weighs the value of lost years of labor market experience and education against the value of any enhancements to learning that occur due to later school entry.

Costs and Benefits of Increasing Age at School Entry: Empirical Evidence

Estimating the effect of age at school entry on education and labor market outcomes is empirically challenging. Children who enter school later are likely different from those who start

earlier. This produces omitted variables bias in a regression of these outcomes on age at entry. The bias is of an unpredictable sign. Some children will start late because they are developmentally delayed, inducing a spurious, negative correlation between age at school entry and the outcomes of interest. Others will start late because their parents want them to rank high in the pecking order of their class and have resources to pay for an extra year of private child care, inducing a spurious, *positive* correlation between age at school entry and educational achievement. Dozens of studies (reviewed by Stipek, 2002) run these unpredictably biased regressions; they typically conclude that there is an academic advantage to starting later but that it is gone by third grade.

Assume for the moment that the age at which children start school is randomly assigned, so our omitted-variables biases magically melt away. A researcher tests children in a given grade and relates their scores with their age at school entry. The researcher sees that children who start school later have higher test scores and GPAs. Is *this* conclusive evidence that starting school later improves learning? No. Among children in a given grade, the researcher can't separate the effect of *age at school entry* from that of *age at test*. In a given grade, any child who starts school later is also older when she takes the test. Except among those children who repeat (or skip) a grade, age at entry and age at test are perfectly collinear (Black, Devereaux and Salvanes, 2008): that is, *age at test = age at entry + years of schooling.* This connection poses a big problem for researchers, because age-at-test effects on test scores are strong and positive. This connection holds especially true among young children, for whom a few months can make a large difference in cognitive development. Even *before* children enter school, a few months' difference in age produces large differences in cognitive skills (Elder and Lubotsky, forthcoming). A teacher or principal observing these differences might conclude that, since older children in kindergarten do better than younger children, we should increase the kindergarten entry age. But the bottom line is that researchers *cannot* determine the effect of age at school entry by studying school-age children, since we can never get away from the fact that age-at-test rises in lockstep with age-at-entry.[7]

[7] A number of recent studies have used quasi-random methods to examine the relationship between age at entry and academic performance (Bedard and Dhuey, 2006; Puhani and Weber, 2007; Elder and Lubotsky, forthcoming). While they deal successfully with omitted variables bias, they are unable to untangle the effects of age at entry and age at test.

Among adults, we have some hope of estimating the effect of age at school entry (*if* we have dealt with the omitted variables problem). Among adults, do we find a strongly positive correlation between age at school entry and earnings or IQ? No. Researchers have shown that adults in Norway and Sweden who entered school later have slightly *lower* earnings and IQ. These studies have exploited sharp discontinuities in the impact of school entry laws to eliminate omitted variables bias (Black, Devereaux, and Salvanes, 2008; Fredriksson and Ockert, 2005).

In the United States, researchers have also established a negative, causal link between age at school entry and education and labor market outcomes. One of the best-grounded findings in the economics of education is that compulsory schooling laws matter. Using multiple methods, multiple datasets, and multiple natural experiments, researchers have consistently found that legal constraints on when children can enter school, exit school, and work for pay significantly affect their school attendance and attainment. Angrist and Krueger (1991, 1992) launched this literature with their analysis of the relationship between quarter of birth, educational attainment, and earnings among men born in the early twentieth century. The typical entry rule for these cohorts was that children who would turn six by the end of December could start first grade in September. Children born in the first quarter would therefore have to wait until the September *after* they had turned six to enter first grade, while their peers born in the fourth-quarter could enter up to three months *before* they turned six. The consequence of this later entry was that those born in the first quarter were one to two percentage points less likely to graduate high school than those born in the last quarter. Reductions in education have been shown to decrease life expectancy (Lleras-Muney, 2005), happiness (Oreopoulos, 2007), and civic participation (Dee, 2004; Milligan, Moretti, and Oreopoulos,2004), as well as to increase crime rates (Lochner and Moretti, 2004), and earnings.

Angrist and Krueger (1991, 1992) concluded that the relevance of compulsory schooling laws was fading with time, as social norms about children's work and education shifted. However, among recent birth cohorts the effects of compulsory schooling laws on high school graduation rates are about as large as those estimated by Angrist and Krueger (Dobkin and Ferreira, 2007). This outcome may be due to rising age at school entry, which makes a given school exit law bind for more young adults. Using regression-discontinuity methods with data on exact date of birth from Texas and California, Dobkin and Ferreira show that those assigned (by

entry laws) to enter school a year later are about one percentage point less likely to complete high school. Among Hispanics, the reduction is twice as large.

Two recent papers appear to contradict this extensive literature on the negative impact of later entry on educational attainment. Bedard and Dhuey (2006) find that those who enter later are more likely to attend a university track in British Columbia and more likely to take exams required for admission to a selective college and to attend a four-year college in the United States. Puhani and Weber (2007) similarly find that those who enter school later are more likely to follow the *Gymnasium* university-preparatory track in Germany. But these studies show no positive impact of age at school entry on years of completed education. Their results, like the research on competitive athletes, is consistent with the idea that relative age provides an advantage in rank-order tournament competitions, which characterizes admission to elite schooling tracks, selective universities, and competitive sports teams.

Most students who delay school entry will not drop out of high school. For them, the cost of delayed school entry is delayed entry into the labor force. Assuming a fixed retirement age, these adults will have one less year of earnings at the start of their work life, and their subsequent earnings will be lowered by the loss of one year of experience. Data from Norway and Sweden confirm this prediction: those who started school later than their peers have lower annual earnings when they are in their mid twenties (Fredriksson and Ockert, 2005; Black, Devereaux, and Salvanes, 2008) though this negative effect appears to fade as workers age (Black, Devereaux, and Salvanes, 2008). This finding makes intuitive sense: the loss of one year of experience will have a larger impact on workers who have recently entered the labor force than workers with decades of experience.

Decreased labor force participation has social as well as private costs. The increase in the dependency ratio caused by dropping fertility and the retirement of the baby boomers has been the subject of intensive discussion. The Social Security retirement age has recently been raised by two years, from 65 to 67. The intent of this new policy, which was the subject of extensive economic analysis and political debate, was to increase the years that workers spend paying into Social Security. Figure 1 suggests that this effort will partially be undone by increasing age at school entry. One out of six children born in 1999 delayed first grade by a year. These delayed students will be delayed workers who pay one year less into the Social Security system.

Conclusion

Given the pace of research in this area, we will likely soon have the evidence we need to more confidently calculate the social welfare consequences of the graying of kindergarten. While we cannot yet say whether the net effect is zero or negative, we can say with near certainty that increasing age at school entry intensifies *inequality* in human capital and social welfare. Both red-shirting and increases in the legal age of school entry have this variance-increasing effect on social welfare.

First, increases in the age of legal school entry intensify socioeconomic differences in educational attainment. Lower-income children are at greater risk of dropping out of school when they reach the legal age of school exit; increases in age at school entry therefore disproportionately decrease their completed education. Further, young children who enter school later spend more time in unequal environments. Whether at home or in formal care, children who start school later linger in settings whose quality is positively correlated with parents' human capital. This point is exactly the one made by advocates of early childhood interventions: insofar as home environments are unequal, delaying public schooling increases the likelihood of unequal outcomes (Kirp, 2007; Heckman and Masterov, 2007).

Second, red-shirting disadvantages children who enter school on time. In kindergarten, the most advantaged children are the oldest in the class, reinforcing socioeconomic gaps in school readiness: "[C]hildren who may be at academic risk from factors associated with poverty face the additional hurdle of being compared to advantaged children 12 to 15 months older. . . . the youngest children may appear to be immature and unready to tackle the tasks their significantly older classmates find challenging and intriguing" (Crosser, 1998). Younger children in the classroom are more likely to be labeled as learning disabled (Elder and Lubotsky, forthcoming). Ironically, the racial and socioeconomic segregation of the United States softens this dynamic, since in our school districts the most advantaged and least advantaged children rarely share a classroom. But the standardized test scores of children of the same grade are compared across districts and states, and the relative ages of these children will contribute to the distance between the scores of rich and poor districts.

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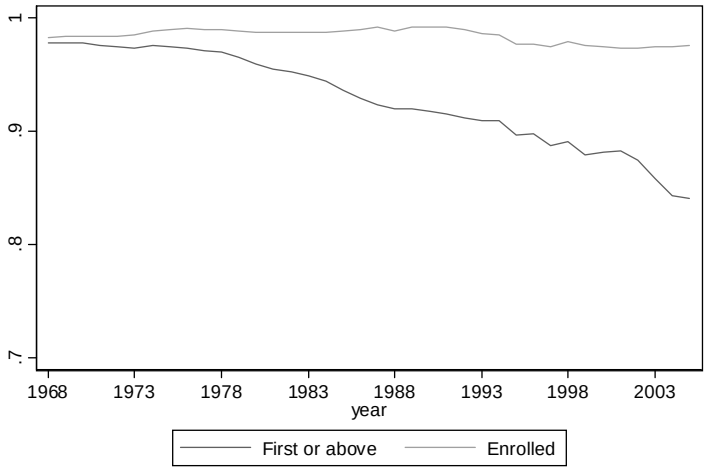
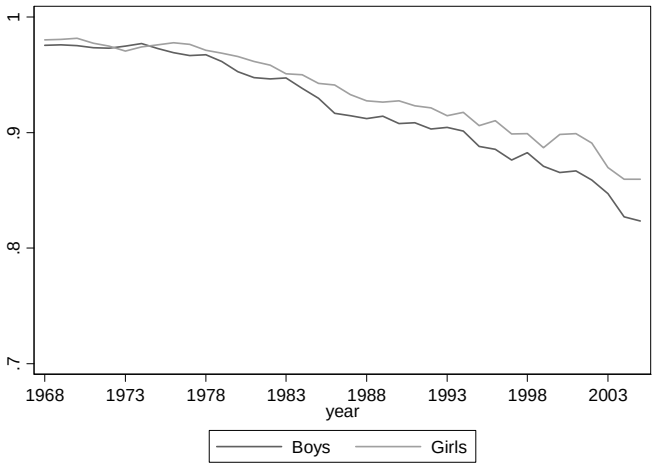
Figure 1
Schooling Trends for Six-Year-Olds, 1968–2005

A: Share Enrolled vs. Share in First Grade or Above

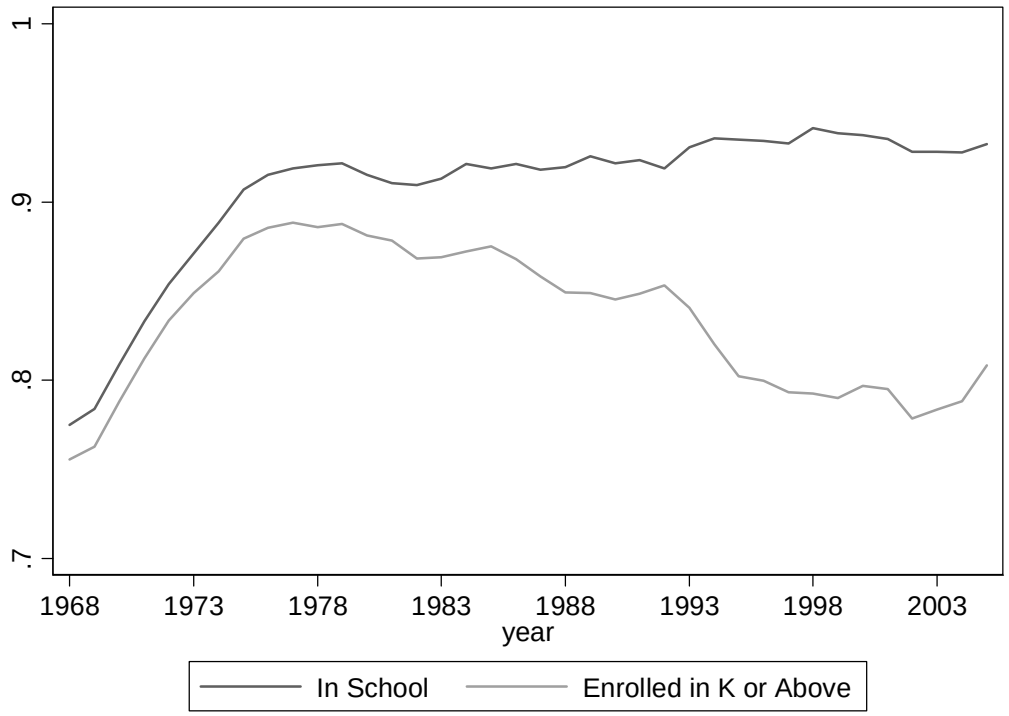


B: Share in First Grade or Above, by Sex



Source: October Current Population Surveys.

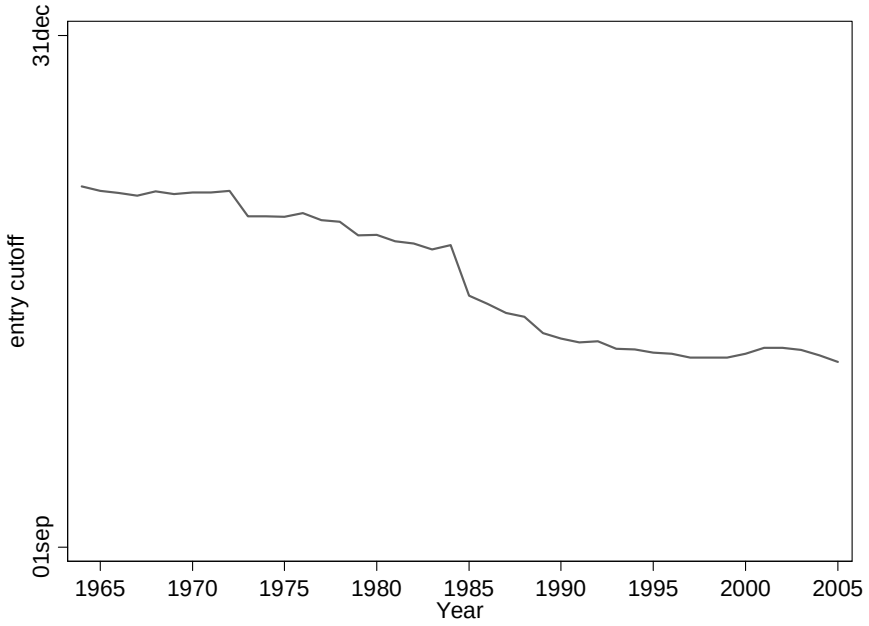
Figure 2
Enrollment Trends for Five-Year-Olds, 1968-2005



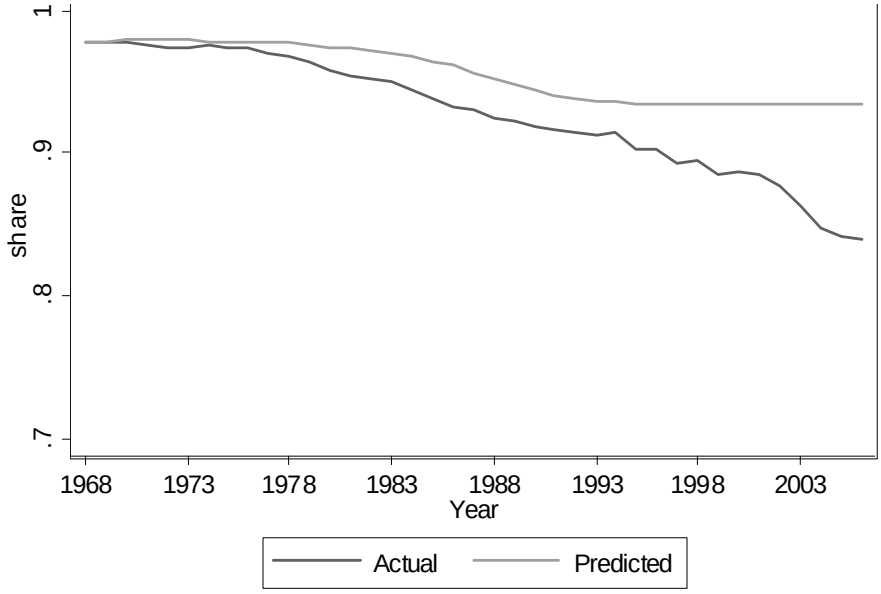
Source: October Current Population Surveys.

Figure 3
Changes in State Entry Laws and Their Effects

A: Average Date by Which a Child Must be Five to Start School in September

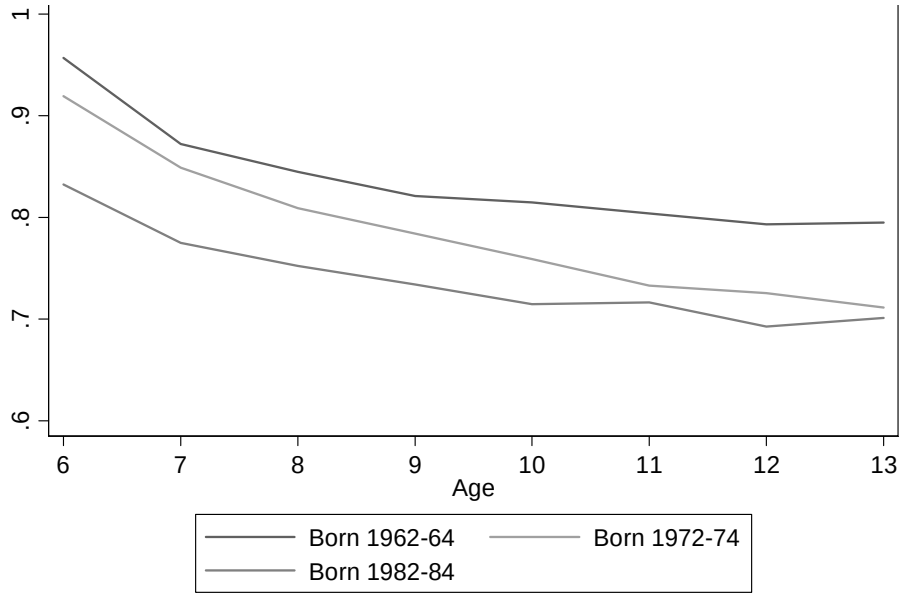


B: Share of Six-Year-Olds in First Grade or Above, Actual and Predicted by Perfect Compliance with State Entry Laws



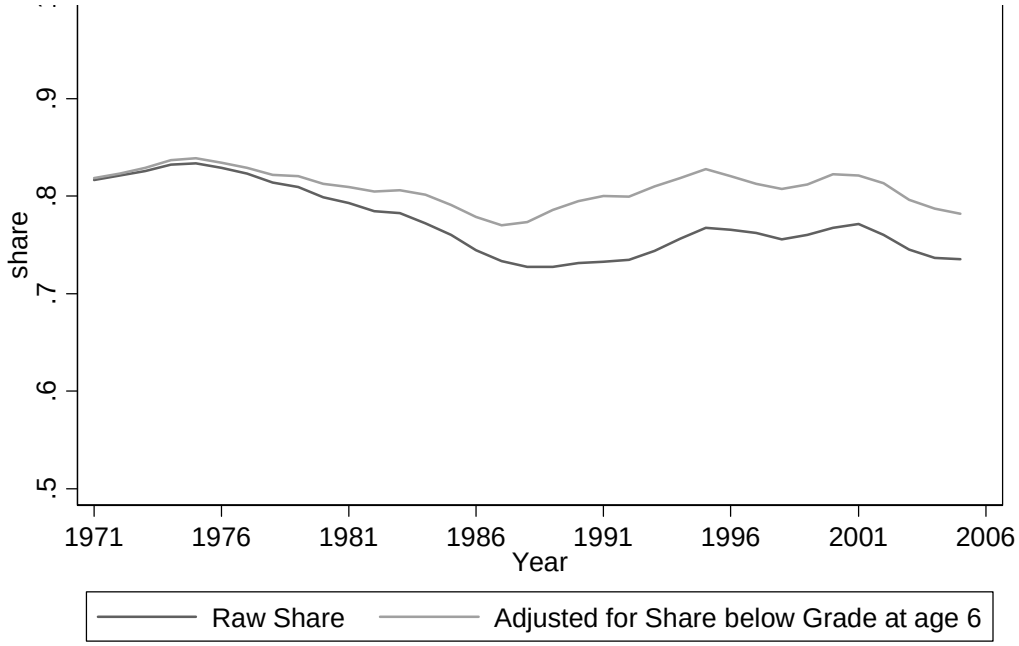
Source: October Current Population Surveys and data on school entry laws from Kelly Bedard and Elizabeth Dhuey.

Figure 4
Shares of Birth Cohorts in Expected Grade or Above



Source: October Current Population Surveys.

Figure 5
Share of Nine-Year-Olds at Expected Grade or Above

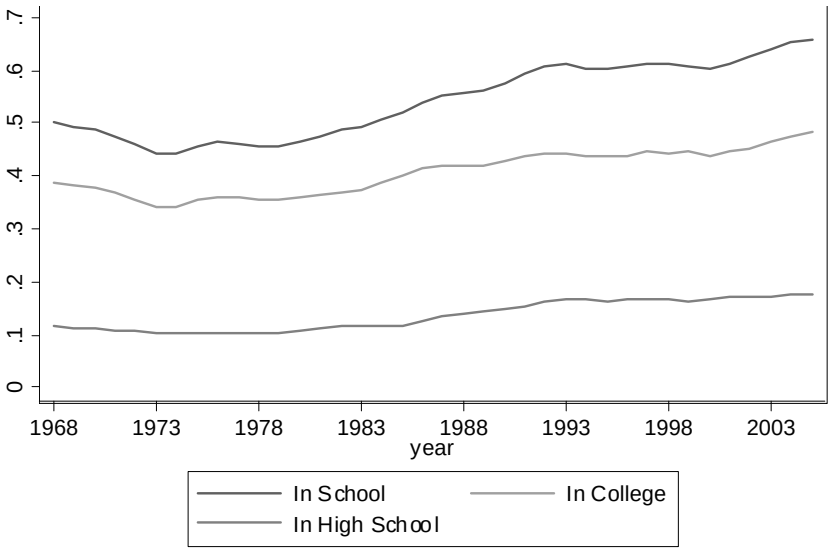


Source: October Current Population Surveys.

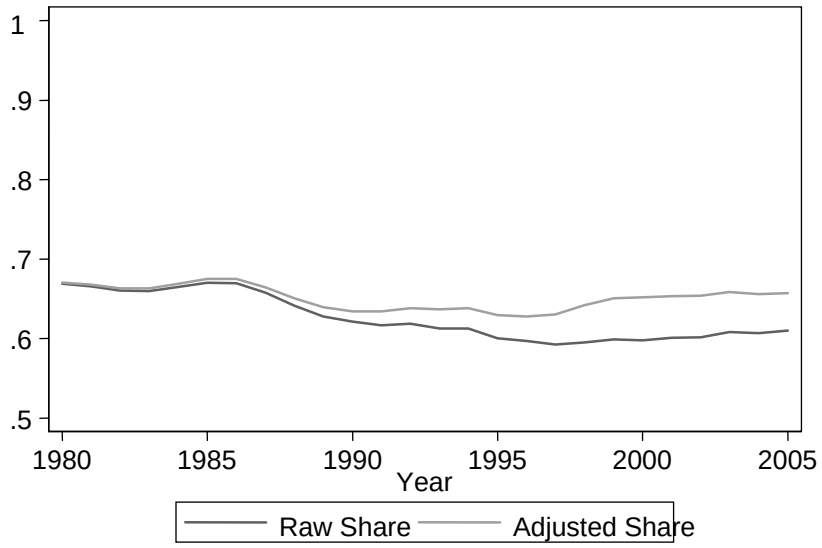
Note: To generate this adjusted series, we regress the share in expected grade at age nine against the share in expected grade at age six and plot the residuals (normed to the actual mean in 1971). The regression is conducted at the level of cell means, weighted by cell size. These cells are defined by the interaction of sex, race, (proxied) year of birth, and nine census divisions for a total of 1,260 (=2 x 2 x 35 x 9) cell means. We proxy for year of birth with survey year minus age. Adding fixed effects at the level of race, sex, census division, and their two-way interactions does not alter the adjusted series.

Figure 6
Enrollment Status of 18–19 Year-Olds

A: Share in High School vs. Share in College

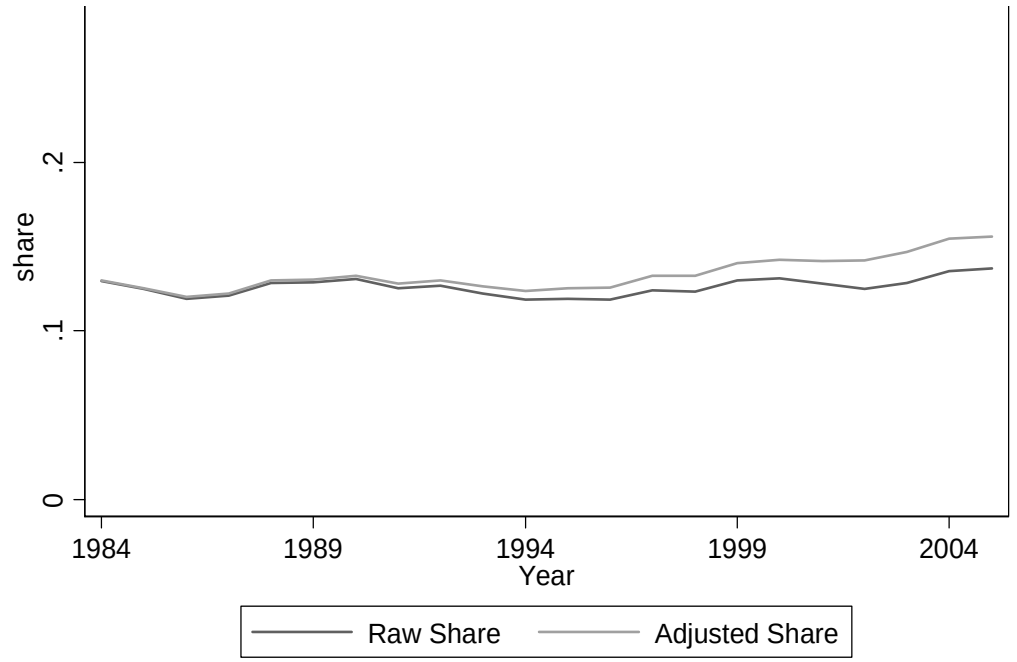


B: High School Graduation Rate, Age 18



Source: October Current Population Surveys.
Note: For explanation of "adjusted share," see note under Figure 5. Note that in the historical Current Population Survey data we cannot distinguish between a traditional high school degree and GED (General Education Development) certification.

Figure 7
Share with a BA Degree, Age 22

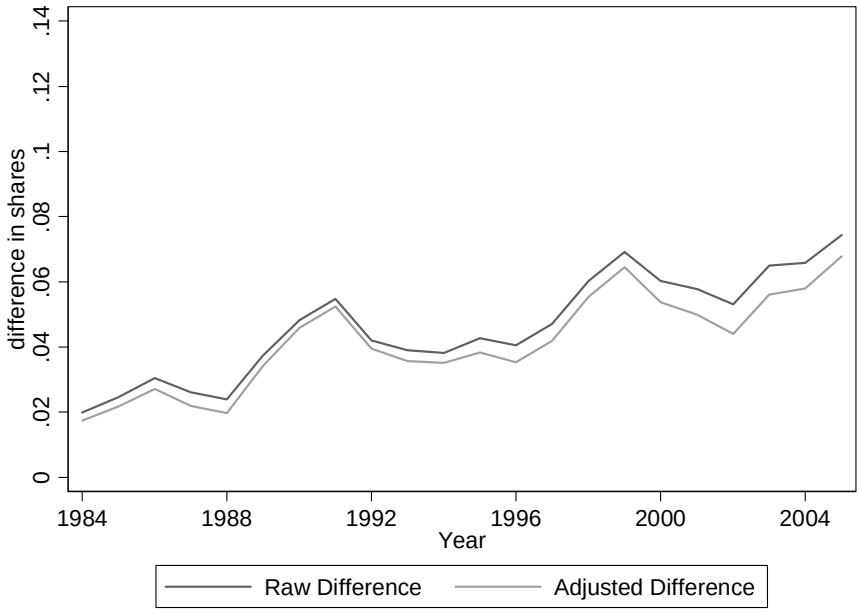


Source: October Current Population Surveys.
Note: See note under Figure 5 for details on the adjustment.

Figure 8
Sex Differences in Educational Attainment
(*Female minus Male)*

A: Share with a High School Degree, Age 18

B: Share with a BA Degree, Age 22



Source: October Current Population Surveys.
Note: See note under Figure 5 for details on the adjustment