

Goldin and Katz and Education Policy Failings in Historical Perspective

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ABSTRACT

In their book *The Race Between Education and Technology*, Claudia Goldin and Lawrence Katz develop a theoretical framework for thinking about central factors in the economy. The framework is rich in the way it integrates a crucial set of dynamics, namely changes in technological advance, in education and skills, in labor-market remunerations, in inequality, and in economic growth. Further, the framework is rich in the way it lends itself to historical narrative and statistical evidence. Finally, the framework suggests very believable theoretical explanations, particularly for increasing inequality—explanations that may help to diminish other, less believable, explanations.

The framework is not new to specialists in labor economics and inequality, but the book adds empirical detail. The book integrates theory and evidence in a way that makes learning accessible to public discourse. In this review essay, we will make a number of criticisms of the book, but the book also has numerous strengths and represents a provocative addition to the policy debate on the critical issues it addresses. The basic framework—captured in the statement that *technology is skill-biased*—is a great contribution, one that might well be fundamentally sound, subject to scrutiny and perhaps revisions in execution. We can only salute the scholarly vision of the project. We are persuaded that economists should follow Goldin and Katz in the way that they frame the important questions explored by *The Race between Education and Technology*. However, in several respects they over-reach their data in an attempt to support interventionist policy recommendations.

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The “Skill-Bias” of Technology: Explaining Inequality in Terms of a “Race”

The software spreadsheet program Microsoft Excel is upgraded every few years. When an upgrade occurs, some of the functions are reconfigured. Think of Excel as a metonym for the edge of technology available for widespread commercial application.

Very often we acquire an upgrade but prefer to use the old version. If skills do not keep up with technology, one might be *less* productive with the new version. Moreover, even if one’s absolute productivity remains the same, if other users gain the skills suited to the new version, one falls behind *relative* to other workers.

The new version of Excel is more powerful. Figure that some portion of users is sure to become skilled in it. Their productivity surges ahead, potentially far beyond the less skilled. If we imagine an Excel-based economy, the new version creates a *demand* for the new skills. Wage rates for skilled labor will depend on its scarcity. The skilled workers get paid the most, and the premium depends on how abundant the new skills are. If you are one of those who has excelled in Excel, then you will command the highest wages. But if many have gained the new skills, the premium will be moderated. If you are one who has not gained the new skills, you might still do OK—after all, the economy is more productive, so you can buy more for a dollar. But in a relative sense, you might fall behind. Thus, if technology advances and the workforce profile of complementary skills becomes more skewed, such that the portion with high capability, like “superstars” (Rosen 1981), get large premiums, inequality may increase. Goldin and Katz speak of a “race” between technology and education: Inequality grows as the distribution of education (actually, what matters are capabilities or skills) becomes more skewed relative to the advancement of technology. The story tends to make the assumption, which we find reasonable, that a portion of the population will manage to acquire the high-level skills that complement the newest technology, and the focus is on how well the lagging remainder keep apace with those who excel. The “race” that Goldin and Katz speak of is really a race among people: Can “the pack” maintain their earnings positions relative to, say, those in the 90th percentile of capabilities? It is a race between individuals in their levels of capabilities, but it is a race whose terms are affected by technological advancement. One can imagine contestants racing through an obstacle course. Logistical changes in the course can make it ever more difficult for the pack to maintain their positions relative to the most athletic contestants (see Figure 1).

Figure 1: Technological advancement extends the zipline in the race, possibly increasing the gap between the best and the modal contestant.



Photo credit: The photo is copied from the [website](#) of the NBC TV show American Gladiators.

Technical change is skill-biased if, *with a frozen* array of marketable skills, it would disproportionately reward the most skilful. The purpose of the modifier “skill-biased” is not so much to distinguish skill-biased technical change from non-skill-biased technical change. Goldin and Katz see technology as being skill-biased in general. GK speak of “skill-biased technical change” to inculcate the theoretical structure of their analysis.

We accept the premise of skill-bias, and we hail Goldin and Katz for making it their theoretical fulcrum. But there remain questions about whether the skill-bias has been increasing. Is the increase in the gap a result of intensifying skill-bias, or flagging skill acquisition among “the pack,” or a combination of both? GK’s story holds that the skill-bias was fairly constant throughout the twentieth century (7-8, 121), and that the growing gap stems from a slowdown in skill acquisition. We suspect that the gap has increased for a combination of reasons, and we differ with Goldin and Katz in the diagnosis of the pack’s skill-acquisition slowdown and in policy prescriptions.

Goldin and Katz apply the theory to about 150 years of American history starting with the rise of the common schools system in the nineteenth century, through the “high-school movement” of the first half of the twentieth century, and continuing right up today. The narrative, in a nutshell, holds that America through the earlier generations, but for failures to blacks and other minorities (5), did a great job of educating the workforce so as to keep up with technology, and

hence achieve a broad-based sharing of the fruits of economic and technological development. But after 1970 or so, education began to “lose the race” with technology, such that skill advancement no longer occurred in the same broad-based way. Thus, the last thirty years saw increasing inequality. The book ends with advice that would seem to follow from the book’s theoretical structure: rejuvenate education so that it again keeps up with technology. In particular, GK make a pitch for more college for more people. If we can induce a young woman to graduate from college and acquire skills, she will enter a higher-skilled job market and earn more than she would have. Moreover, *she slightly shifts out the higher-skilled supply curve*, and shifts back the lower-skilled supply curve, thus reducing the wage gap between the two markets. By getting more of the stragglers to get more skills, inequality will be ameliorated. GK give much empirical attention to the reasonable proposition that a rise in the supply of college graduates relative to non-graduates raises average productivity and reduces the gap between earnings of college graduates and the earnings of non-graduates.

In this review we avoid controversies over the measurement of inequality—*wealth* inequality might especially bear revisiting in light of the unfolding crash of 2008. Regardless of those issues, the book’s basic theoretical structure makes sense. Some of the trends in inequality over the past several decades might well be the result of skills not keeping up with technology. One of the book’s greatest contributions, in our view, may be to elevate this explanation above other explanations. Goldin and Katz (309) report that trends in immigration probably don’t much explain trends in the college wage premium. Their theory could also help to diminish other popular explanation of inequality, such as trends in globalization, unionization, and minimum wages.

Systematic Bias in the Execution of the Work

Despite its excellent theoretical core and scholarly vision, *The Race between Education and Technology* is systematically flawed. The whole execution shows a social-democratic partiality. The book presupposes that we are rooting for greater income-equality, and hence for education to “keep up” with technology. Boosting education helps us achieve a broad-based sharing of the fruits of the economy, hence more of a common experience: During the first three-quarters of the twentieth century, “Americans grew together as economic growth was shared throughout the income distribution during much of the period” (87). Also, boosting education is a concrete aim to which we may put our collective efforts.

Such values may be a matter of taste. But ideological motivation seems, in this case, to have led to distortions in the historical narrative, misunderstanding of the recent decades, dubious policy suggestions, and misplaced hope of “keeping up” with technology. In their final chapter, GK suggest that policy reforms

with good benefit-cost ratios are available to raise the relative supply of college graduates without significant loss of graduate quality. But this policy proposition receives little support. Indeed, flaws in the historical interpretation relate directly to problems in the policy advice.

Our criticisms include the following: We see a need to distinguish between attending school and becoming capable or skilful; We criticize the way that Goldin and Katz talk about “years of schooling” as a continuous variable, when the underlying phenomenon is that the combination of high school graduation rates and college attendance rates increased more slowly after 1970 primarily because of a slowdown in the *former*, a slowdown which was arithmetically driven by the fact that high school graduation rates can only go up to 100 percent; We criticize the way they break up time periods in a way that buries the productivity acceleration of 1990-2005 . This acceleration is more consistent with the view that technology surged ahead than with the view that growth in skills fell off. We see a need to recognize the profound institutional changes that occurred during the twentieth century, for their consequences can help to explain why the populations’ skills are not “keeping up” with technology. Goldin and Katz suggest policy changes to improve modal skills by way of increasing the number of quality-maintained college graduates, and we suggest that they do not give us reason to believe that such an increase is viable, particularly by the means they suggest.

The Slow-Down in Human Capital Formation

A key empirical finding is that over the past 30 years or so there has been a slowdown in the rate of increase in educational attainment. This can be seen in GK’s table 3.1 (96). Plausibly, skill advancement had occurred primarily through increased years of schooling. But a plausible partial explanation for the reduction in the rate of growth in significant skills, in our view, is that we are seeing sharply diminishing returns to years of schooling.

The data from Goldin and Katz (for Census years they also include separate lines for the Current Population Survey) are shown below in Table 1. This table gives the educational composition of the labor force in various census years. It shows the percentages of high-school dropouts, high-school graduates with no college, “some college,” and college graduates.

Table 1: Composition of the U.S. Labor Force by *Highest* Educational Attainment

Year	High School Dropouts	High School Graduates	Some College	College Graduates
1950	58.6	24.4	9.2	7.8
1960	49.5	27.7	12.2	10.6
1970	35.9	34.7	15.6	13.8
1980	20.7	36.1	22.8	20.4
1990	11.4	33.0	30.2	25.4
2000	8.7	29.6	32.0	29.7

Source: Goldin and Katz (2008, table 3.1, p. 96)

Note that the labor force reflects the *cumulative* changes in educational attainment of the preceding decades. Between 1970 and 1980, the change in labor force composition would reflect, for example, the addition of people who completed their schooling during that decade and the retirement of people who finished their schooling about four decades earlier.

From 1950 to 1980, the main shift driving the rise in average educational attainment of the work force was from high-school dropouts to high-school graduates. The proportion of high-school dropouts in the labor force plunged from 58.6 percent to 20.7 percent, which cannot be repeated because, as GK point out, “An upper bound exists for a graduation rate; it cannot exceed one” (325). Approaching one is also likely to encounter diminishing returns and escalating unit costs. And since the late 1960’s, the high school graduation rate has been on a slight downward trend. According to James Heckman and Paul LaFontaine (2007), the peak graduation rate was about 80 percent, and subsequently it edged down by 4 or 5 percentage points.

GK include general equivalency development (GEDs) in their high school graduation figures, which raises their graduation rates by 7 or 8 percentage points. Heckman and LaFontaine (2008) argue that the skill profile of a typical GED is much closer to that of high-school dropouts than high-school graduates. Furthermore, much of the rise in GEDs took place subsequent to the peak in graduation rates. If Heckman and LaFontaine are correct about GEDs, then GK are understating the decline in high school graduation rates. This means that the slowdown in human capital formation, as measured by years of schooling, is actually somewhat greater than they have indicated.

Why No Productivity Slowdown?

Given the slowdown in educational attainment, we might expect to clearly discern a sharp productivity slowdown. However, “across the entire period from 1915-2005, the direct contribution of educational advance within the workforce of 0.34 percent per year explains about 14 percent of the average annual increase in labor productivity of 2.47 percent (see Table 1.3). *The differences by subperiod are slight*” (39-40, emphasis added). That makes sense, because while schooling yields mostly general skills and knowledge, productivity data reflect specialized training, natural inclinations, and other niche pursuits of comparative advantage. When it comes to productivity growth, specialized training and niche pursuits can do much to make up for a slowdown in education-gains. There’s also good reason to believe that productivity growth could have been faster over the entire period. A closer reading of Diane Ravitch’s *Left Back: A Century of Failed School Reforms*, a book in the GK bibliography, but under-utilized by them, documents a longstanding malaise in the performance of the primary and secondary school system that would suggest a steady, not accelerated, drag on productivity partly offset until the last few decades by growth in years of schooling. Indeed, in table 1.3 (39), GK report that average productivity growth during 1980-2005 was over 2/3 of a percentage point below its 20th Century peak of 2.92 percent from 1940-1960, a major dip when compounded over decades.

Additional questions about GK’s data interpretation arise when we divide the 1980-2005 period into two sub-periods. From 1980-1990, productivity growth was 1.78 percent, a substantial slowdown that might be consistent with the slowdown in human capital formation. However, from 1990-2005, productivity growth averaged 2.42 percent, which represents a substantial rise. Given that educational attainment did not accelerate from the first period to the second, the relationship between educational attainment and overall productivity is not nearly as stable as GK report on the basis of aggregating 1980-2005 into a single time period. The relationship between schooling and economic performance is not as simple and straight-forward as GK portray it to be. Lumping 1980-2005 into a single time period blurs the productivity acceleration of the latter period, an acceleration that suggests that whatever slowdown took place in years of schooling was more than offset by gains in technology and in non-school-based skill formation.

The College Wage Premium

Consider an economy of “skill-biased technological change:” new technology increasingly replaces low-skilled labor and is complementary to high-skilled labor. Machines displace assembly-line workers and make designers and marketers more valuable. Computers replace clerks and make statisticians more valu-

able. Technological change unfolds so as to enhance the productivity of high-skilled workers proportionately more than the productivity of low-skilled workers. Workers without the skills to use new technology are left behind.

GK see skill-biased technological change unfolding steadily or consistently over the past century. A slowdown in human capital formation should increase its scarcity and raise its rate of return. GK express their view as follows:

During the first three-quarters of the twentieth century, the rising supply of educated workers outstripped the increased demand caused by technological advances. Higher incomes were accompanied by lower inequality. But during the last two decades of the century the reverse was the case and there was sharply rising inequality...The skill bias of technology did not change across the century, nor did its rate of change. Rather, the sharp rise in inequality was largely due to an educational slowdown. (7-8)

GK measure the return on human capital as the ratio of the wage of college graduates to that of high-school graduates. Recall, however, that the largest change in the composition of the labor force was a slowdown in the shift from high-school dropouts to high-school graduates. It would not be easy to argue that a slowdown in the rate of human capital formation *within* the high-school category was a large part of the cause of a change in the wage differential *between college graduates and high-school graduates*.

Instead, one would think that the college-wage premium would depend on the growth of college graduates compared to the (unmeasured) growth in skill-biased technological change. However, the data in Table One (above) show that the share of college graduates in the labor force rose by 2.8 percentage points from 1950-1960, by 3.2 percentage points from 1960-1970, by 6.6 percentage points from 1970-1980, by 5.0 percentage points from 1980-1990, and by 4.3 percentage points from 1990-2000. Using the share of the labor force graduating from college to measure human capital formation, and using percentage points to measure the differential, there was not much of a slowdown in the latter decades.

To show a slowdown in college graduation, one could use the *percentage change* in the college-graduate rate as a measure of the increase in supply (rather than the growth in percentage points). The 2.8 percentage-point increase from 1950 to 1960 was a percentage-change increase of 36 percent, while the 4.3 percentage-point increase from 1990 to 2000 was percentage-change increase of only 17 percent.

If the supply of college graduates had grown by 36 percent per decade from 1960 to 2000, then in 2000 the share of college graduates would be 36.3 percent rather than 29.7 percent. Presumably, something like this is what it would have taken to prevent the rise in the college wage premium that took place in recent de-

cares. Using this method of measuring educational attainment, we always have to run faster just to stay in place. What GK have to say here boils down to this: Over the past forty years, the supply of college graduates rose too slowly to prevent the college wage premium from growing. They go on to suggest that this represents a major public policy failure.

Is More Governmentalization Really the Answer?

GK write, “For many reasons, then, the United States *must* find a way to increase the stock of educated Americans” (325, emphasis in original). The final words of the book are: “America was once the world’s education leader. The rest of the world imported its institutions and its egalitarian ideals spread widely. That alone is a great achievement and one that calls for an encore (353).” The policy suggestions are vague and somewhat tepid, but the thrust is to call for government action to increase educational attainment. Thus, the pitch is more governmentalization of education. This policy posture conforms to what we see as one of the book’s major flaws, namely, the failure to see how governmentalization has been a source of the very problem explored. Whereas GK prescribe more governmentalization, we diagnosis over-governmentalization and would prescribe the de-governmentalization of education.

The longest part of the book, covering pages 129-286, is a history of American education policy. GK write of the 1900-1970 as an egalitarian success. “By the early 1970s one could say that America ‘had it all’” (289). However:

Everything came to a halt in the 1970s. America started to grow more slowly and Americans began to grow apart. The last quarter of the twentieth century and the early twenty-first century have been distinguished by exploding inequality, chiefly at the upper end of the income distribution. (87)

Yet GK never tell of the profound politicization and bureaucratization that occurred during the years leading up 1970, much less treat them as possible explanations for a flagging of education, particularly among less gifted students who are more critically dependent on the quality of schooling. Beyond slight nods (as in a brief paragraph on 348), GK neglect the following changes and related research:

- Although GK occasionally remark fleetingly on the unfortunate loss of jurisdictional competition by virtue of decentralization (129, 340), they never let on that between 1939 and 1970 the number of school districts fell from 117,108 to 17,995; a drop of nearly 85%. Figuring in popu-

lation growth, the number of students per district *increased about twelve-fold*.³ The period from 1939 to 1970 represents a great transformation from the local community-based public school to the great bureaucratic system. It is the period that James Coleman, in studying the impact of community on educational gains, treats as a transition from family and community institutions to “society” or political instrumentality (Coleman and Hoffer 1987). Yet Goldin and Katz make no mention of Coleman’s seminal work on schooling, which emphasized the importance of value and functional community in learning gains made by individual students between 10th and 12th grade.

- GK also neglect that between 1935 and 1980 the share of local funding of schools fell from about 82 to 45 percent, nor that after 1960 teacher unionization skyrocketed (Hoxby 2004). Also neglected are issues of the narrowing and politicization of the teacher pipeline. Working hand-in-glove, certification requirements and education-degree programs have been highly detrimental to teacher quality (Lieberman 2007, ch. 4).
- GK never discuss the growth of federal involvement in schooling. They did not discuss the alarm about failing school performance, represented by reports like *A Nation at Risk* (National Commission on Excellence in Education 1983), and the diagnosis of over-bureaucratization in well-known works like Chubb and Moe (1990).

Thus, GK’s historical overview is suspect. Besides neglecting the institutional transformations, it does not include an assessment of education performance. Beyond the long-term problems of the K-12 system documented by Ravitch (2000), recent decades have seen especially sharply declining efficiency (Hoxby 2004), including little change in measured academic performance in recent decades, sharp decline for decades prior to that, and likely overall decline throughout in light of recent narrowing of the curriculum to pursue improved math and reading scores.

Instead of systematically examining the institutional factors underlying the education malaise, GK extrapolate the U.S. ascension to world economic leadership into a call for an education policy encore. GK argue that America’s leadership in expanding access to schooling occurred because of “public funding, public provision, and the separation of church and state.” The themes of Coleman, Chubb and Moe, and many other leading scholars could be integrated into GK’s theoretical core. It is quite plausible that the increasingly socialistic nature of the school system helps explain trends in school performance, the degradation of educational standards, and rising inequality.

3 See the data of the National Center for Education Statistics, [here](#) and [here](#).

Dubious Policy Suggestions

GK's praise of the high-school movement and their focus on increased college graduation could imply that we should now have public funding and public provision of universal college education. This might mean that each of our existing public school districts should be expanded to include college as well as high school. Perhaps college should be compulsory. But GK do not follow through on their analogy so as to arrive at such an agenda.

GK save their policy discussion for the last chapter, the shortest in the entire book. A key question is whether some people who do not attend college would benefit from doing so. GK write:

Recent estimates of the rate of return to a year of schooling have used 'natural experiments' from policies that have increased access to college, changed college tuition subsidies or merit aid, and altered compulsory schooling laws. These carefully executed studies using plausibly exogenous variation in educational attainment find high rates of return to further schooling. (336)

The support for their claims of high rates of return to further schooling consists of three citations. The first two are survey articles by David Card (Card 1999; Card 2001). The third is a book chapter by Philip Oreopoulos (2008). We take issue with those papers but we relegate the matter to an appendix found at the end of this paper. In our view, the evidence cited by GK to suggest that more current high school graduates could benefit from college is rather flimsy, and even more so in light of other evidence. For example, James Heckman (2008) summarizes a large body of research that argues that cognitive ability and important socio-emotional skills are largely determined by family background and early childhood experiences. "Most of the gaps at age 18 that help to explain gaps in adult outcomes are present at age five. Schooling plays a minor role in creating or perpetuating gaps" (Heckman 2008, 12).

Other evidence that increasing access to college education may not be sufficient is provided by the report of the Spellings Commission, which said:

Close to 25 percent of all students in public high schools do not graduate... According to the National Assessment of Educational Progress (NAEP), only 17 percent of seniors are considered proficient in mathematics, and just 36 percent are proficient in reading... Forty-four percent of faculty members say students aren't well prepared for college-level writing, in contrast to the 90 percent of high school teachers who think they are prepared... Some 40 percent of all college students end up taking at least one remedial course. (U.S.

Department of Education 2006)

Clifford Adelman (1999) found that nearly forty percent of students who attend college have not obtained a degree after eight years. This would appear to raise questions about whether *too many* students are attempting college. College completion rates are strongly correlated with indicators of preparedness, such as high school grade point average, standardized test scores, and highest level of demonstrated mathematical competence. Moving further down the distribution of academic preparedness would likely do little or nothing to increase the supply of (quality-maintained) college graduates.

GK discuss specific policies on pp. 346-352. Regarding K-12 education, they assert that, “studies show that smaller class size, higher teacher salaries, and summer learning opportunities improve student outcomes” (347). However, they note that “critics...counter that increased average per pupil spending and reduced average class size in recent decades have neither increased test scores nor enhanced educational attainment. The solutions [according to the critics] . . . would be to enhance accountability through testing and standards, devise alternative approaches to teacher selection and retention, and increase parental choice” (348). But there is no real engagement of the “critics,” and they sidestep the important contention of over-governmentalization. Moreover, after pledging fidelity to benefit-cost comparison, Goldin and Katz neglect cost-effectiveness issues, such as that class size reduction yields uncertain benefits at an undeniably high cost.

At this point, GK stop short of endorsing any policies. Instead, they write, “The K-12 system is less than perfect for many students, but it is important to recognize that schools are essentially failing particular students. Those left behind by the system are mainly minority children in inner-city schools who become the youths who are not college ready” (348); an incredible statement for two economists. In a book devoted to analyzing price signals and incentives, GK fail to note the K-12 system’s almost total lack of price signals, and that misaligned incentives and sharply sagging productivity exist system-wide (Hoxby, 2004). Again, there is 25 years of scholarship showing that that the government schools in general are ailing, and that socio-economic differences explain virtually all of the differences in generally low levels of academic achievement. The Heckman (2008, 12) finding cited above that, “schooling plays a minor role in creating or perpetuating gaps” provides additional support for the notion that the vast majority of schools are mediocre or poor. So, it is especially important to recognize that schools are not just failing particular students. That some students are performing especially badly does not mean that a sizable portion of those not at the bottom are doing fine. GK cite no evidence for the implied view that it is “mainly minority children in inner-city schools” that are not college ready. As we noted earlier, the Spellings Commission report suggests that the problems are broader. Yet GK write: “Policies that provide more immediate financial incentives for doing well in school hold

the promise of breaking down the barriers facing disadvantaged children who want to learn and excel in school” (348).

But GK recognize deeper problems and suggest more governmentalization:

But even policies that target school-age children may come too late for kids from troubled families and inadequate early learning environments...Parenting programs and early childhood interventions, such as Head Start...are likely to be complementary with later human capital investments. (348-49)

Having dealt with disadvantaged youth, GK discuss access to college. They point out that “More generous college financial aid for low-income youth and a more transparent financial aid system have the potential to expand college-going and completion.” They cite evidence that resource constraints hinder individual students in attending and completing college. However, Heckman (2008) cites evidence that, on the contrary, “tuition costs explain little of the gap in college going between the affluent and less affluent, between rich and poor, and between majorities and minorities” (11). Furthermore, GK do not show that an aggregate jump in financial aid would increase college graduation. College preparedness is likely a much bigger factor in holding down graduation and skill acquisition.

GK round out their policy recommendations with the following:

A modest increase in tax rates at the very top end of the income distribution can provide revenue to fund payroll tax relief for lower-wage workers, a more generous earned income tax credit, and greater health care access. This approach could provide an immediate move toward greater economic equity. The erosion of labor market institutions (such as the minimum wage and unions) has exacerbated the market forces that have driven the recent rise of U.S. wage inequality. (351)

Finally, GK do not consider that many young people would benefit more from vocational education than from college. Murray (2008) makes a strong case for that.

Concluding Remarks

GK presented their findings in such a way as to suggest that renewed government efforts in education are called for. In fact, David Brooks, writing in the *New York Times*, gives high praise to Goldin and Katz (Brooks 2008b), and takes

their message to heart: “During the 20th century, Americans were better educated than the citizens of any other power. Since 1970, that lead has been forfeited, producing inequality, and wage stagnation. To compete, the U.S. will require a series of human capital initiatives” (Brooks 2008a). A reader of GK could easily walk away with the impression that much of our economic growth over the past hundred years was due to government intervention in education, and that further intervention could yield great results.

As noted above, GK suggest that educational attainment accounts for fourteen percent of the rise in productivity over the past century. However, their approach uses relative wages to measure productivity. At least some of this wage differential may reflect the U.S. economic system’s effectiveness at driving improved allocation of resources, specialized on-the-job training, and ability rather than schooling *per se*. Even if we grant that higher educational attainment explains about fourteen percent of the average annual rise in labor productivity, no one would presume to credit all of that increase to government intervention. Some of the learning attainment reflects natural private responses to the incentives to learn. GK did not measure the marginal contribution of policy, and GK’s empirical findings suggest that the marginal contribution of recent policy could be negative. As we have intimated throughout this essay, we need to mind the distinction famously made by Mark Twain when he wrote: “I never let my schooling interfere with my education.” Even more precisely, we need to distinguish between schooling and remunerative capabilities or skills.

The sweeping nature of GK’s exhortations for new initiatives stands in sharp contrast to the dearth of quantitative evidence that their list of recommended policies would achieve much. We suspect that summing the results from even the most optimistic studies of GK’s recommended approaches for pre-school intervention, modest K-12 reform, and increased college financial aid, would not yield a predicted increase in the college attendance or graduation rate of as much as one percentage point, and a connection to increased capabilities is less certain.

GK offer no evidence to back their recipe for making college-ready 18-year-olds out of children with below-average ability, and particularly for children born into adverse family settings. They barely mention “parental choice” and quickly express doubts (348). They neglect the indirect evidence that strongly argues for an expanded role for market signals and entrepreneurship in K-12 education (see Walberg 2007 for an overview).

GK ignore direct strategies to remove regulatory obstacles at the lower end. For example, GK might have suggested the liberalization of occupational licensing as a way of raising the lower end of the income scale. Occupational licensing affects more than 25 percent of US workers, and is thought to raise the cost and restrict the number of practitioners (Kleiner and Krueger 2008; Kleiner 2006).

Finally, GK neglect the possibility that there is some inevitability in technology outpacing modal skills and capabilities. To our mind, it makes sense that

advancing technology can give ever more astonishing productivity to those in the upper tail. Also, to our mind, it makes sense that a formative period is naturally built into the limits of the human mind—an idea raised by GK (22, 325, 336) but rejected without solid grounds, in our view. There’s no reason to think that everyone can just add more and more years of schooling and get a constant improvement in capability. For these reasons, GK may be building false hopes of “keeping up” with technology. Perhaps technology will “win the race” against model capabilities and be a source of increasing inequality. GK produced a book that is a call to action to enact policies intended to raise the college graduation rate. It is likely to influence politicians and pundits. Its rhetoric promotes what Murray (2008) calls the “romantic view” that nearly everyone should go to college. Murray introduces readers to a large body of education research debunking the romantic myths.

Goldin and Katz have produced a work with a strong theoretical core, an impressive array of methods, and a vision that everyone should admire for its breadth, learning, and relevance to important issues. With suitable revisions in execution, the investigation might actually generate diagnoses and prescriptions quite contrary to those found in the book.

Appendix: Commentary on the David Card and Philip Oreopoulos works that Goldin and Katz cite to support the claim of high rates of return to further schooling.

As noted, Goldin and Katz support for their claims of high rates of return to further schooling by citing three works. The first two are survey articles by David Card (Card 1999; Card 2001), the third is a book chapter by Philip Oreopoulos (2008). Both of the articles by Card survey essentially the same set of papers, only a handful of which purport to be natural experiments occurring in the United States. Typical of these papers is Card (1995), in which growing up near a four-year college is treated as a natural experiment that would lead youths with less ability to complete more education, thus allowing the econometrician to separate ability from education.

Card looked at how educational attainment and earnings vary according to how close an individual lived to a four-year college when he or she was growing up. His assumption is that, regardless of one’s ability level, those who grow up closer to colleges have lower costs of deciding to attend college. Thus, growing up a closer to colleges is a bit like having assistance or a price discount to attend college. The approach supposedly helps the investigator to capture the marginal value added of college attendance, rather than have this value be confounded with ability.

Card estimated earnings functions, where the parameter of interest is the

additional salary from an additional year of schooling. He found that this coefficient was higher for those living near a college. His interpretation is that students at the lower end of the wealth scale benefit *more* at the margin (in terms of boosted earnings) from easier access to college than do students at the high end. He suggests that much of the marginal gains accrued to students at the low end of the ability spectrum.

Card's suggests that increased access to college produces high benefits at the margin. However, that is not the only possible factor that could account for his results. For example, the economies in the regions surrounding colleges could be more skill-biased, such that students from those regions do especially well after they conclude their schooling. Card controlled for observable family characteristics, such as family income and educational attainment, but families living in college neighborhoods could have unobserved characteristics that make for higher return from college for their children. It is quite plausible that regions with more colleges excel in imparting skills, curiosity, confidence, sophistication, and aspirations to their children—by institutions, culture, and peer effects—such that those children go on to do better than their college-years counterparts who grew up in regions less steeped in academics.

The third citation is a forthcoming book chapter by Philip Oreopoulos (2008). He looked at states that changed the age of compulsory schooling from the 16-year norm to either 17 or 18 years. The data are summarized in Table two, below.

Table 2: Proportion of Young People in School, by Age and State Compulsory School Age

	Compulsory age 16	Compulsory age 17	Compulsory age 18
Percentage in school at age 16	96.6 %	96.3 %	97.1 %
Percentage in school at age 17	92.3	92.4	93.9
Percentage in school at age 18	75.4	75.2	74.8

Source: Oreopolous 2008, Table 2, p. 35

As Oreopoulos writes, “Indeed, most 16 year-olds are attending school, regardless of the minimum school leaving age in the state in which they reside. The fraction of students in school at age 16 is about the same across states with different school leaving ages. Contrary to what we would expect, the fraction of 17 year-olds in school does not spike up for youths in states with a school leaving age of 18: 6.1 percent of 17 year-olds in states with a leaving age of 18 have dropped out, compared to 7.7 percent in states with a leaving age of 16” (8). Another striking aspect of the table is the large decline of the fraction in school between age 17

and age 18. Oreopoulos makes no comment about this, nor does he offer any explanation. Overall, most of the variation in school attendance is *not* accounted for by differences in state laws.

Undaunted, Oreopoulos proceeds with a regression methodology in which the dependent variables are various measures of an individual's schooling and earnings, while the independent variable of interest is an indicator of whether the age of compulsory schooling in the individual's state is 16, 17, or 18. The results of the regression models are that living in a state with a higher age of compulsory schooling correlates with slight increases in each of the following probabilities: completing high school, going on to have some college, being employed, and having higher earnings. Given the raw data in table 2, it is difficult to view this as a convincing study. Oreopoulos asks us to believe that compulsory school laws that are ineffective in raising attendance rates are nonetheless valid instrumental variables in regression equations.

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