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Skills, Education and the Rise of Earnings Inequality among the "Other 99 Percent"

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The singular focus of public debate on the "top 1%" of households overlooks the component of earnings inequality that is arguably most consequential for the "other 99%" of citizens: the dramatic growth in the wage premium to higher education and cognitive ability. This review documents the central role of both the supply and demand for skills in shaping inequality, discusses why skill demands have persistently risen in industrialized countries, and considers the economic value of inequality alongside its potential social costs. I conclude by highlighting the constructive role for public policy in fostering skills formation and preserving economic mobility.

Introduction

Public debate has recently focused on a subject that economists have been analyzing for at least two decades: the steep, persistent rise of earnings inequality in both the U.S. labor market and in developed countries more broadly. Much popular discussion of inequality concerns the "top

1 percent," referring to the increasing share of national income accruing to the top percentile of households. While this phenomenon is undeniably important, an exclusive focus on the concentration of top incomes ignores the component of rising inequality that is arguably even more consequential for the "other 99 percent" of citizens: the dramatic growth in the wage premium to education and, more broadly, cognitive ability. This paper considers the role of the rising skill premium in the evolution of earnings inequality.

There are three reasons to focus a discussion of rising inequality on the economic return to skills and education. First, the earnings premium for education has risen across a large number of advanced countries in recent decades, and this rise contributes substantially to the net growth of earnings inequality. In the U.S. for example, approximately two-thirds of the overall rise of earnings dispersion between 1980 and 2005 is proximately accounted for by the rising returns to schooling—primarily the growing premium to postsecondary education. (*1, 2*) Second, while there is as yet little consensus among economists regarding the primary causes of the rise of very top incomes, (*3–6*) an influential literature finds that the interplay between the supply and demand for skills provides substantial insight into why the skill premium has risen and fallen over time—and, specifically, why the earnings gap between college and high school graduates has more than doubled in the U.S. over the last three decades. A third reason for focusing on the skill premium is it offers broad insight into the evolution of inequality within a market economy, highlighting the social value of inequality alongside its potential social costs and illuminating the constructive role for public policy in maximizing the benefits and minimizing the costs of inequality.

The rising skill premium is not, of course, the sole cause of growing inequality. The decades-long decline in the real value of the U.S. minimum wage (*7*), the sharp drops in non-college employment opportunities in production, clerical and administrative support positions stemming from automation, the steep rise in international competition from the developing world, the

secularly declining membership and bargaining power of U.S. labor unions, and the successive enactment of multiple reductions in top federal marginal tax rates, have all served to magnify inequality and erode real wages among less-educated workers. As I discuss below, the foremost concern raised by these multiple forces is not their impact on inequality per se, but rather their adverse effect on the real earnings and employment of less educated workers.

I begin below by documenting the centrality of the rising skill premium to the overall growth of earnings inequality. I next consider why skills are heavily rewarded in advanced economies and why the demand for them has risen over time. I then demonstrate the substantial explanatory power of a simple framework that embeds both the demand and supply for skills in interpreting the evolution of the inequality over five decades. After laying out both the productive role that inequality plays in a market economy and the potential risks attending very high and rising inequality, the final section summarizes evidence on whether those risks have been realized, highlights specific causes for concern, and discusses the role of policy and governance in encouraging skills formation, fostering opportunity, and countering the possibility that extremes of inequality erode economic mobility and reduce economic dynamism.

1 The Critical Role of Skills in the Labor Market

There is no denying the extraordinary rise in the incomes of the top 1 percent of American households over the last three decades. Between 1979 and 2012, the share of all household income accruing to the top percentile of U.S. households rose from 10.0 to 22.5 percent. (*8,9*) To get a sense of how much money that is, consider the conceptual experiment of redistributing the gains of the top 1 percent between 1979 and 2012 to the bottom 99 percent of households (*10*). How much would this redistribution raise household incomes of the bottom 99 percent? The answer is $7,107 per household, a substantial gain, equal to 14 percent of the income of the median U.S. household in 2012, where I focus on the median because it reflects the earnings of

the typical worker and thus excludes the earnings of the top 1 percent.

Now consider a different dimension of inequality: the earnings gap between U.S. workers with a four-year college degree versus those with only a high school diploma (*11*). Economists frequently use this college/high-school earnings gap as a summary measure of the 'return to skill'—that is, the gain in earnings a worker can expect to receive from investing in a college education. As illustrated in Figure 1, the earnings gap between the median college educated and median high-school educated among U.S. males working full-time in year-round jobs was $17,411 in 1979, measured in constant 2012 dollars. Thirty-three years later, in 2012, this gap had risen to $34,969, almost exactly double its 1979 level. Figure 1 further reveals a comparable trend among U.S. female workers, with the full-time, full-year college/high-school median earnings gap nearly doubling from $12,887 to $23,280 between 1979 and 2012. As Figure 1 underscores, the economic payoff to college education rose steadily throughout the 1980s and 1990s and was barely impacted by the Great Recession starting in 2007.

Since the educational earnings calculations in Figure 1 reflect individual incomes while the top 1 percent calculations reflect household incomes, the two calculations are not directly comparable. To put the numbers on the same footing, consider the earnings gap between a college-educated two-earner husband-wife family and a high-school educated two-earner husband-wife family, which rose by $27,951 between 1979 and 2012 (from $30,298 to $58,249). This increase in the earnings gap between the typical college and high-school household earnings levels is four times as large as the redistribution that has notionally occurred from the bottom 99 percent to the top 1 percent of households. What this simple calculation suggests is that the growth of skill differentials among the "other 99 percent" is arguably even more consequential for the welfare of most citizens than the rise of the 1 percent.

The median earnings comparisons in Figure 1 also convey a key feature of rising inequality that cannot be inferred from trends in top incomes: wage inequality has risen throughout the

earnings distribution, not merely at top percentiles. Figure S1 in the Online Supplement documents this pattern by plotting for twelve OECD countries over three decades (1980 - 2011) the change in the ratio of full-time earnings of males at the 90th percentile relative to males at the 10th percentile of the wage distribution. While the 90/10 earnings ratio differs greatly across countries at the start of the sample—from a low of 2.0 in Sweden to a high of 3.6 in the United States—this earnings ratio increased substantially in all but one of them (France) over the next thirty years, growing by at least 25 percentage points in 10 countries, by at least 50 percentage points in 8 countries, and by more than 100 percentage points in three countries (New Zealand, the U.K. and the U.S.).

How much does the rising education premium contribute to the rise of earnings inequality? While data limitations make it difficult to answer this question for most countries, we do know the answer for the United States. Goldin and Katz (*1*) find that the increase in the education wage premium explains about 60 to 70 percent of the rise in the dispersion of U.S. wages between 1980 and 2005 and, similarly, Lemieux (*12*) calculates that higher returns to postsecondary education can account for 55 percent of the rise in male hourly wage variance from 1973–75 to 2003–05. Firpo, Fortin, and Lemieux (*13*) find that rising returns to education can explain just over 95 percent of the rise of the U.S. male 90/10 earnings ratio between 1984 and 2004. That is, holding the expanding education premium constant over this period, there would have essentially been no increase in the relative wages of the 90th percentile relative to the 10th percentile worker.

I have so far used the terms education and skill interchangeably. What evidence do we have that it is skills that are rewarded per se rather than simply educational credentials? The Program for the International Assessment of Adult Competencies (PIAAC) provides a compelling data source for gauging the importance of skills in wage determination. The PIACC is an internationally harmonized test of adult cognitive and workplace skills (literacy, numeracy, and

problem-solving) that was administered by the Organization for Economic Cooperation and Development (OECD) to large, representative samples of adults in 22 countries between 2011 and 2013 (*14*). Figure 2, sourced from (*15*), plots the relationship between adults' earnings and their PIACC numeracy scores across these twenty-two countries. The height of each bar reflects the average percentage earnings differential between full-time workers ages 35 - 54 who differ by one standard deviation in the PIACC score. The whiskers on each bar provide the 95 percent confidence intervals for the estimates.

This figure conveys three points. First, cognitive skills are substantially rewarded in the labor market across all twenty-two economies. The average wage premium to a one "unit" (i.e., one standard deviation) increase in measured cognitive skills is 18 percent. In addition, cognitive earnings premia differ substantially across countries. The premium is below 13 percent in the Sweden, the Czech Republic, and Norway. It is above 20 percent in six countries. Third, the U.S. stands out as having the highest measured return to skill, with a premium of 28 percent per unit increment to cognitive ability. Concretely, comparing two U.S. workers who are one standard deviation above and one standard deviation below the population average of cognitive ability, respectively, we would expect their full-time weekly earnings to differ by 50 to 60 percent. Notably, the high return to cognitive ability in the U.S. does <u>not</u> follow automatically from high levels of U.S. earnings inequality. If U.S. wages were determined mainly by luck, beauty, or family connections, we would expect little connection between workers' cognitive ability and their labor market rewards (*16*). Figure 2 demonstrates that this is not the case.

Of course, these data do not explain why the skill premium has risen over time, nor why the U.S. has a higher skill premium than so many other advanced nations. The next section considers the supply and demand for skill in the labor market, specifically, why they fluctuate over time and how their interaction helps to determine the skill premium. I focus particularly on the U.S. in this section to allow a deeper exploration of the data.

2 Education and Inequality

Workers' earnings in a market economy depend fundamentally (some economists would say entirely) on their productivity—that is, the value they produce through their labor. And in turn, workers' productivity depends on two factors. One is their capabilities, concretely, the tasks they can accomplish (i.e., their skills). A second is their scarcity: the fewer workers that are available to accomplish a task, and the more employers need that task accomplished, the higher is workers' economic value in that task. In conventional terms, the skill premium depends upon what skills employers require (skill demand) and what skills workers have acquired (skill supply). To interpret the evolution of this premium, we need to account for both forces.

2.1 Skill Demands: The Long View

A technologically advanced economy requires a literate, numerate, and technically and scientifically trained workforce to develop ideas, manage complex organizations, deliver healthcare services, provide financing and insurance, administer government services, and operate critical infrastructure. This was not always the case. In 1900, four in ten U.S. jobs were in agriculture, 11 percent of the population was illiterate, a substantial fraction of economic activity required hard physical labor, and workers' strength and physical stamina were key job skills. (*17, 18*) Few citizens would have predicted at the time that a century later, health care, finance, information technology, consumer electronics, hospitality, leisure and entertainment would employ far more workers than agriculture—which employed only 2 percent of U.S. workers in 2010. As physical labor has given way to cognitive labor, the labor market's demand for formal analytical skills, written communications, and specific technical knowledge—what economists often loosely term cognitive skills—has risen spectacularly.

The central determinant of the supply of skills available to an advanced economy is its education system. In 1900, the typical young, native-born American had only a common school

education, about the equivalent of six to eight grades (*19*). By the late 19th century, however, many Americans recognized that farm employment was declining, industry was rising, and their children would need additional education to earn a living. Over the first four decades of the twentieth century, the U.S. became the first nation in the world to deliver universal high school education to its citizens. Tellingly, the high school movement was led by the farm states.

As the high school movement reached its conclusion, post-secondary education became increasingly indispensable to the growing occupations of medicine, law, engineering, science, and management. In 1940, only six percent of Americans had completed a four-year college degree. From the end of World War II to the early 1980s, however, the ranks of college-educated workers rose robustly and steadily, with each cohort of workers entering the labor market boasting a proportionately higher rate of college education than the cohort that preceded it. This inter-cohort pattern, which was abetted by the World War II and Korean War GI Bills (*20*) and by huge state and federal investments in public college and university systems, is depicted in the first panel of Figure 3. From 1963 through 1982, the fraction of all U.S. hours worked that were supplied by college graduates rose by almost one percentage point per year, a remarkably rapid gain.

After 1982, however, the rate of inter-cohort increase fell by almost half—from 0.87 percentage points to 0.47 percentage points per year—and did not begin to rebound until 2004, nearly two decades later. As shown in Figure S2 in the Online Supplement, this deceleration in the supply of college graduates is particularly stark when one focuses on young adults with fewer than ten years of experience—that is, the cohorts of recent labor market entrants at each point in time. While the supply of young college-educated males relative to young high school-educated males increased rapidly in the 1960s and early 1970s—and indeed throughout the post-war period—this rising tide reached an apex in 1974 from which it barely budged for the better part of the next 30 years. Among young females, while the deceleration in supply was

not as abrupt or as complete as for males, it is also unmistakable.

The counterpart to this deceleration in the growth of supply of college-educated workers is the steep rise in the college premium commencing in the early 1980s and continuing for twenty-five years. Concretely, when the influx of new college graduates slowed, the premium that a college education commanded in the labor market increased. The critical role played by the fluctuating supply of college education in the rise of U.S. inequality is documented in the lower panel of Figure 3, which plots the college wage premium from 1963 through 2012 (blue line). This premium fluctuated in a comparatively narrow band during the 1960s and 1970s, as rising demand for educated workers was met with rapidly rising year-over-year increases in supply. In 1981, the average college graduate earned 48 percent more per week than the average high school graduate—a significant earnings gap but not an earnings gulf. When the supply deceleration began in 1982, however, the college premium hit an inflection point. This premium notched remarkably rapid year-over-year gains from 1982 forward, reaching 72 percent in 1990, 90 percent in 2000, and 97 percent in 2005 (*21, 22*). Thus, over the space of twenty-three years, college graduates went from earning one-and-a-half times as much to twice as much as non-college workers.

Why is this deceleration in supply relevant to the college premium? After all, although the growth of supply *slowed* in 1982, it was still rising. A likely answer is that the demand for college workers rose in the interim. Throughout much of the twentieth century, successive waves of innovation—electrification, mass production, motorized transportation, telecommunications—have reduced the demand for physical labor and raised the centrality of cognitive labor in practically every walk of life. The last three decades of computerization, in particular, have extended the reach of this process by displacing workers from performing routine, codifiable cognitive tasks—e.g., bookkeeping, clerical work, and repetitive production tasks—that are now readily scripted with computer software and performed by inexpensive digital machines.

This ongoing process of machine substitution for routine human labor complements educated workers who excel in abstract tasks that harness problem-solving ability, intuition, creativity and persuasion—tasks that are at present difficult to automate but essential to perform. Simultaneously, it devalues the skills of workers, typically those without postsecondary education, who compete most directly with machinery in performing routine-intensive activities. The net effect of these forces is to further raise the demand for formal education, technical expertise, and cognitive ability (*23–27*).

2.2 Bringing the Supply-Demand Framework to the Data

The persistently rising demand for educated labor in advanced economies was first noted by the Nobel Prize winning economist Jan Tinbergen (*28*), and is often referred to as the "education race" model (*19*). Its primary implication is that if the supply of educated labor does not keep pace with persistent outward shifts in demand for skills, the skill premium will rise. In the words of the Red Queen in Lewis Carroll's *Alice in Wonderland*, *"*....it takes all the running you can do, to keep in the same place." Thus, when the rising supply of educated labor began to slacken in the early 1980s, a logical economic consequence was an increase in the college skill premium.

To more formally account for the impact of the fluctuating growth rate of supply of college-educated workers on the college wage differential, the lower panel of Figure 3 depicts the fit of a simple regression model that predicts the college wage premium in each year as a function of two factors: (1) the contemporaneous supply of college graduates; and (2) a time trend, which proxies for the secularly rising demand for college workers (*29*). Comparing the fitted values (red series) from this simple supply-demand model alongside the actual data (blue series), demonstrates an extremely tight correspondence over the course of five decades and three distinct eras: a declining skill premium in the 1970s; an explosive rise in the premium during

the 1980s, 1990s and early 2000s; and, most recently, a plateau commencing after 2005. A key implication of this figure is that a central causal factor behind rising inequality in the United States has been the slowdown in the accumulation of skills by young adults almost thirty years ago. Had the supply of college graduates risen as rapidly in the decades after 1980 as it did in the decades immediately before, it is quite plausible that there would have been no sustained rise in the skill premium in the U.S. labor market.

Of course, this set of facts raises another puzzle: if slackening college supply sparked rising inequality, what caused rising U.S. post-secondary achievement to grind to a sudden halt in 1982? Work by Card and Lemieux (*30*) highlights that one critically important factor was the United States' involvement in the Vietnam War. Because draft-eligible males in the Vietnam era were often able to defer their military service by enrolling in post-secondary schooling, the War artificially boosted college attendance. This created something of a glut of college enrollments in the late 1960s and early 1970s, which, in turn, depressed the college earnings premium in the 1970s (see Figure 3) and likely reduced the attractiveness of college-going absent the military draft. Thus, when the War ended in the early 1970s, college enrollment rates dropped sharply, particularly among males. The fall in enrollment produced a corresponding decline in college completions half a decade later, and a surge of inequality to follow.

This supply-demand explanation for the rise of U.S. inequality may appear almost too simple to be credible. After all, we are just comparing two economic variables: the college wage premium and supply of college graduates in the U.S. workforce. But a host of rigorous studies commencing with Katz and Murphy (*31*) confirm the remarkable explanatory power of this simple supply-demand framework for explaining trends in the college-versus-high-school earnings gap over the course of nine decades of U.S. history, as well as across other industrialized economies (most notably, the United Kingdom and Canada), and among age and education groups within countries (*19, 31–36*). It also bears emphasis that the U.S. was far from the only

Western country to experience this surge.

One should not of course take this model as gospel. A puzzling pattern evident in the data is that the rising demand for skilled workers appears to slow in the early 1990s, a phenomenon that is not anticipated by the "education race" model (*37*). This discrepancy underscores that the supply-demand model is necessarily incomplete—in part for the sake of expositional clarity and, in larger part, because our understanding of macroeconomic phenomena is typically imperfect. Nevertheless, the data speak sufficiently clearly to warrant two economic inferences.

A first is that while popular accounts frequently assert that the U.S. is in the midst of a "college bubble"—too many students going to college at too high a cost—abundant economic evidence strongly suggests otherwise. Yes, college tuitions have risen far faster than inflation, and indeed, student debt has risen rapidly, with more than $100 billion in federal student aid dollars loaned in 2012-2013 alone (*38*). But the doubling of the college weekly wage differential over the last thirty years also implies that there been sizable increases in the lifetime earnings of college graduates relative to high school graduates. How large are these gains? Figure 4, reproduced from Avery and Turner (*39*), reports the estimated lifetime college earnings differential net of tuition for cohorts of students entering the labor market between 1965 and 2008. For both males and females, the expected net present value of a college degree relative to a high school diploma roughly tripled in this period, with the fastest gains accruing during the 1980s and 1990s. It bears note that this growing college/high-school gap reflects the rising payoff to the four-year college degree, the even steeper rise in the premium to graduate and professional degrees (visible in Figure 6 below), and the growing fraction of college graduates who obtain higher degrees; thus, an additional payoff to the college degree is that it opens the door to further specialization. This lifetime earnings differential would of course have risen further still had college tuitions held steady rather than rising. Nevertheless, the inevitable sticker shock that households feel when confronting the cost of college should not obscure the fact that the

real lifetime earnings premium to college education has likely never been higher (*40*).

The second positive economic news implied by Figure 3 above is that the ongoing rise of skill differentials is not inevitable. While prior cohorts of U.S. students, particularly males, were slow to react to the rising return to education during the 1980s and 1990s, the message appears to have finally gotten through. During the first decade of the twenty-first century, the U.S. high school graduation rate rose sharply, after having been essentially stagnant since the late-1960s (*41*). This unanticipated rise was followed just a few years later by a surge in college completions. Between 2004 and 2012, the supply of new college graduates to the U.S. labor market rose at a rate not seen in several decades (Figure 3a). As this influx of supply took hold, the college wage premium halted its enduring rise (Figure 3b). What these observations—and our simple supply-demand model—suggest is that the flattening of the college premium after 2005 is in large part a consequence of the quickening pace of educational attainment.

3 Inequality: Causes for Concern?

A market economy needs *some* inequality to create incentives. If, for example, students were not ultimately rewarded for spending their early adulthoods pursuing college, professional and graduate degrees, or if the hardest-working and most productive workers were paid the same as the median worker, then citizens would have little incentive to develop expertise, to exert effort, or to excel in their work (*42*). Having acknowledged that *some* inequality is necessary, however, how can we gauge whether there is too much of it? I offer two analytical perspectives on this question, the latter of which suggests significant cause for concern.

3.1 Earnings mobility

One metric by which to evaluate the consequences of inequality is via its relationship with economic mobility—that is, the degree to which individual economic fortunes change over time.

Of particular interest is the degree of *intergenerational* mobility, meaning the likelihood that children born to low income families become high income adults and vice versa. High levels of economic inequality at a given point in time are not intrinsically inimical to economic mobility; a society with high inequality may be dynamic—meaning, lots of movements up and down the economic ladder—and one with low inequality may be dynastic. But a natural concern is that high inequality at a point in time may serve to reduce mobility over time. If, for example, adults who became wealthy through hard work are able to "buy" success for their children through outsized investments and personal connections, while conversely, adults who are unproductive or unlucky in their careers are unable to muster the resources to foster their children's potential, then inequality of incomes could become self-perpetuating—even if it originally emanates from high market returns to skill. (*43*)

To understand the significance of high and rising U.S. inequality, it is therefore useful to ask how U.S. economic mobility compares to that of other developed countries, and whether U.S. mobility has fallen as inequality has risen. The answers to both questions will surprise many. Contrary to conventional civic mythology, U.S. intergenerational mobility is relatively *low*. The first panel of Figure 5, reproduced from Corak (*44*), which plots the relationship between cross-sectional inequality (x-axis) and earnings mobility (y-axis) among a set of 13 OECD countries for which consistent data are available, documents that the U.S. has both the lowest mobility and highest inequality among all wealthy democratic countries. The second panel of Figure 5, also sourced from Corak (*44*), suggests one proximate explanation for this pattern: countries with *high* returns to education tend to have relatively *low* mobility. Why, if education is "the great equalizer" in the words of Horace Mann, do high educational returns predict low mobility? A key reason is that educational attainment is highly persistent within families. Indeed, two of the strongest predictors of children's ultimate educational attainment are parental education and parental earnings (*45, 46*). Hence, when the return to education

is high, children of better-educated parents are doubly advantaged—by their parents' higher education and higher earnings—in attaining greater education while young and greater earnings in adulthood. Figure 5 therefore lends credence to the concern that rising inequality may erode economic mobility.

Has this erosion occurred? Surprisingly, the best evidence to date suggests that it has not. Evidence from Chetty et al. (*46*), documented in the Online Supplement, underscores the message from Figure 5 that there is substantial economic *immobility* in the United States. Children born three deciles apart in the household income distribution are on average one decile apart in the earnings distribution at age 29-30. Similarly, children born three deciles apart in the household income distribution differ by twenty percentage points in their probability of attending college at age 19 (relative to a mean of approximately 55 percent). Yet, these data offer no evidence that mobility has appreciably changed among children born prior to the historic rise of U.S. inequality (1971-1974) and those born afterward (1991-1993). As far as we can measure, rising U.S. income inequality has not reduced intergenerational mobility so far. These findings, which also appear to hold over a longer historical timeframe (*47*), suggest that U.S. mobility has not trended downward as many social scientists would have anticipated, and as many policymakers and popular accounts frequently assume.

It is important to interpret these results in context. The most recent birth cohorts whose adult outcomes can be observed at present were born no later than the early 1990s, which is still relatively early in the rise of U.S. inequality. Another ten years of data, focusing on children born since 2000, may suggest a different conclusion. Moreover, the fact that mobility has stayed constant while inequality has risen means that the lifetime relative disadvantage of children born to low versus high income families has increased substantially; concretely, the rungs of the economic ladder have pulled farther apart but the chance of ascending the ladder has not improved. Finally, it is possible to interpret the fact that mobility has remained unchanged

as evidence that U.S. mobility *would have* declined had it not been for the other compensatory steps that the U.S. took during this period, including, for example, expanding the Earned Income Tax Credit for low income workers in the 1980s, enlarging the early childhood education Head Start program in the 1990s, and increasing federal student grant and loan programs to support college-going. (*48*) Declines in racial and gender discrimination during this period likely also complemented these policies (*49*). A cautious read of the evidence is that although the U.S. is *not* a "land of opportunity" by conventional economic mobility metrics, it has not become *less so* in recent decades.

3.2 Real earnings

A second gauge of economic health is the trajectory of earnings and employment. Here, the data present significant cause for concern. While the substantial college wage premium conveys the positive economic news that educational investments offer large returns, this wage premium also masks a discouraging truth: the rising *relative* earnings of workers with post-secondary education is due not simply to rising *real* earnings among college workers but also due to *falling* real earnings among non-college workers. Between 1980 and 2012, real hourly earnings of full-time college-educated males in the U.S. rose anywhere from 20 to 56 percent, with the greatest gains among those with a post-baccalaureate degree (Figure 6, left-hand panel). Simultaneously, real earnings of males with high school or lower educational levels declined significantly—falling by 22 percent among high school dropouts and 11 percent among high school graduates. While the picture is generally brighter for females (Figure 6, right-hand panel), real earnings growth among females without at least some college education over this three-decade interval was extremely modest.

Accompanying the fall in real wages among less-educated workers has been a pronounced drop in their labor force participation rates, particularly among less educated males. Between

1979 and 2007, prior to the onset of the Great Recession, the fraction of working-age males in paid employment fell by 12 percentage points among high school dropouts and 10 percentage points among those with exactly a high school degree. Conversely, employment rates were generally stable for males with post-secondary education, and rose significantly for females of all education levels except for high school dropouts.

The causes for the sharp falls in real earnings among non-college workers are multiple. One likely force, as above, is the ongoing substitution of computer-intensive machinery for workers performing routine task-intensive jobs. This has depressed demand for workers in both blue collar production and white collar office, clerical, and administrative support positions, and reduced the set of middle-skill career jobs available to non-college workers more generally (*25*). A second factor is the globalization of labor markets, seen particularly in the greatly increased U.S. trade integration with developing countries. Globalization has become particularly important for U.S. labor markets since the early 1990s when China began its extremely rapid integration into the world trading system. While the influx of Chinese goods lowered consumer prices, it also fomented a substantial decline in U.S. manufacturing employment, contributing directly to the decline in production worker employment (*50*). A third factor impinging on the earnings of non-college males is the decline in the penetration and bargaining power of labor unions in the United States, which have historically obtained relatively generous wage and benefit packages for blue-collar workers. Over the last three decades, however, U.S. private-sector union density—that is, the fraction of private-sector workers who belong to labor unions—has fallen by approximately 70 percent, from 24 percent in 1973 to 7 percent in 2011 (*51, 52*).

Notably, these three forces—technological change, deunionization, and globalization—work in tandem. Advances in information and communications technologies have directly changed job demands in U.S. workplaces while simultaneously facilitating the globalization of production by making it increasingly feasible and cost-effective for firms to source, monitor and co-

ordinate complex production processes at disparate locations worldwide. The globalization of production has in turn increased competitive conditions for U.S. manufacturers and U.S. workers, eroding employment at unionized establishments and decreasing the capability of unions to negotiate favorable contracts, attract new members, and penetrate new establishments.

In all cases, the foremost concern raised by these multiple forces impinging on the earnings of workers at different skill levels is not their impact on inequality per se, but rather their adverse effect on the real earnings and employment of less educated workers. These declines in both earnings and employment bode ill for the welfare of non-college U.S. adults, and are likely to have broader detrimental social consequences that frequently accompany non-employment: greater criminality, increased social dependency, and (more mundanely) reduced tax receipts.

4 Do Supply and Demand Make Policy Irrelevant?

One potential interpretation of the evidence above is that, because rising inequality is to a significant extent a consequence of the impersonal forces of supply and demand, public policy has no role to play in shaping the trajectory of inequality or its social impact. This conclusion is incorrect for two reasons. A first is that there are multiple channels by which policy has contributed to the rise of U.S. inequality, many of which are not fully evident in the education-earnings premium. These include the fall over several decades in the real value of the U.S. minimum wage (*7*); the declining prevalence and bargaining power of U.S. labor unions; mounting international competition that places particular pressure on the wages and employment of less-educated workers; and sharp reductions in top federal marginal tax rates that have raised after-tax inequality and increased the incentive of highly paid workers to seek still higher compensation. As discussed in the companion paper by Piketty and Saez, there is also significant disagreement among economists about whether the rising share of household incomes accruing to the top few percentiles of households in numerous developed countries over the last several

decades is also primarily a market phenomenon, or, instead whether it reflects changing social norms, growing corporate misgovernance, slackening regulatory oversight, or increasing political capture of the policymaking process by elites (*3–6*). It would therefore be a vast overstatement to conclude that the rise of U.S. inequality is exclusively due to conventional market forces, or that public policy has not played a role.

But let us assume for the sake of argument that the rise of income inequality is entirely a market phenomenon. Would this imply that there is no role for public policy? A moment's reflection suggests otherwise. As the economist Arthur Goldberger once famously observed, the fact that near-sightedness is substantially a genetic disorder has no bearing on whether doctors should prescribe eyeglasses (*53*). What is relevant is whether the benefits of addressing myopia exceed the costs. In the case of myopia, the availability of eyeglasses make this an easy call.

While there is no 'remedy' for inequality that is as swift or cheap as eyeglasses, prosperous democratic countries have numerous effective policy levers for shaping inequality's trajectory and socioeconomic consequences. Policies that appear most effective over the long haul in raising prosperity and reducing inequality are those that cultivate the skills of successive generations: excellent pre-school through high-school education; broad access to post-secondary education; good nutrition and public health, and high quality home environments. Such policies address inequality from two directions: first, enabling a larger fraction of adults to attain high productivity, rewarding jobs, and a reasonable standard of living; and second, raising the total supply of skills to the economy, which in turn moderates the skill premium and reduces inequality (*54*).

Of course, building skills is a multi-generational process and thus it has little impact on inequality in the short term. There are, however, numerous nearer-term levers that moderate inequality directly without imposing substantial economic costs: applying progressive tax and transfer policies that fund public investments and foster opportunities for children of all

socioeconomic backgrounds; applying well-crafted labor regulations that ensure safe and non-exploitive working conditions; providing wage subsidies such as the Earned Income Tax Credit that increase the payoff to employment for those with limited skills; setting modest but non-zero minimum wage rules; and offering numerous social insurance policies (health and disability insurance, flood insurance, disaster assistance, food assistance) that buffer misfortune for the unfortunate.

While it is outside of the scope of this article to evaluate these policies, it is critical to underscore that policy and governance can, has and should play a central role in shaping inequality—even when a central cause of rising inequality is the changing supply and demand for skills.

References and Notes

1. C. D. Goldin, L. F. Katz, *Brookings Papers on Economic Activity* **Fall 2007**, 135.

2. (*1*) find that the increase in the education wage premium, particularly the college premium, explains about 60 to 70 percent of the rise in wage inequality (variance) between 1980 and 2005.

3. F. Alvaredo, A. B. Atkinson, T. Piketty, E. Saez, *Journal of Economic Perspectives* **27**, 3 (2013).

4. J. Bivens, L. Mishel, *Journal of Economic Perspectives* **27**, 57 (2013).

5. A. Bonica, N. McCarty, K. T. Poole, H. Rosenthal, *Journal of Economic Perspectives* **27**, 103 (2013).

6. S. N. Kaplan, J. Rauh, *Journal of Economic Perspectives* **27**, 35 (2013).

7. D. Autor, A. Manning, C. L. Smith, The Contribution of the Minimum Wage to U.S. Wage Inequality over Three Decades: A Reassessment (2010).

8. T. Piketty, E. Saez, *The Quarterly Journal of Economics* **188**, 1 (2003).

9. These calculations use data from (*8*), with data updated to 2012 available at http://elsa.berkeley.edu/ saez/TabFig2012prel.xls. Average U.S. household incomes, including the top 1 percent, rose by 20.2 percent, while the average household income of the bottom 99 percent of households rose by only 3.5 percent.

10. Thus, the top 1 percent maintains its share of household income at a constant 10.0 percent, while average household incomes rise by 20.2 percent, as actually occurred.

11. This point is due to Lawrence Katz of Harvard University, who offers these calculations in his graduate labor economics lecture notes.

12. T. Lemieux, Post-Secondary Education and Increasing Wage Inequality, *Working Paper 12077*, National Bureau of Economic Research (2006).

13. S. Firpo, N. Fortin, T. Lemieux, *Handbook of Labor Economics* **4**, 1 (2011).

14. See http://www.oecd.org/site/piaac/surveyofadultskills.htm for more information. The PIACC program will encompass 33 countries, but data for only 22 were available at this writing.

15. E. A. Hanushek, G. Schwerdt, S. Wiederhold, L. Woessmann, Returns to Skills Around the World: Evidence from PIACC (2013).

16. (*15*) also find that the correlation between numeracy skills and years of schooling is 0.45. When including both numeracy skills and years of schooling in an earnings regression, they find that both are substantial and significant predictors of earnings, though each is attenuated relative to a model where only one factor is included at a time. This pattern of results suggests, logically, that neither tests scores nor years of schooling is a complete measure of labor market skills.

17. T. D. Snyder, 120 Years of American Education: A Statistical Portrait, *Tech. rep.*, U.S. Department of Education: National Center for Education Statistics (1993).

18. L. D. Johnston, History Lessons: Understanding the Decline in Manufacturing (2012).

19. C. Goldin, L. F. Katz, *The Race Between Education and Technology* (Harvard University Press, Cambridge, 2008).

20. M. Stanley, *The Quarterly Journal of Economics* **118**, 671 (2003).

21. B. Pierce, *Labor in the New Economy*, K. G. Abraham, J. R. Spletzer, M. Harper, eds. (University of Chicago Press, Chicago, 2010), pp. 63–98.

22. These comparisons hold constant labor market experience and gender. It bears emphasis that this doubling of the college premium very likely understates the magnitude of the increase in inequality between college and non-college workers. Alongside higher hourly earnings, college educated workers enjoy greater job stability, lower rates of unemployment, more generous fringe benefits, and better working conditions, and Pierce (*21*) finds that these differentials have generally increased in the same time period.

23. D. H. Autor, F. Levy, R. J. Murnane, *Quarterly Journal of Economics* **118**, 1279 (2003).

24. D. Acemoglu, D. H. Autor, *Handbook of Labor Economics* **4**, 1043 (2011).

25. D. H. Autor, D. Dorn, *American Economic Review* **103**, 1553 (2013).

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27. Extensive recent literature, commencing with Autor, Levy and Murnane (*23*) and summarized in Acemoglu and Autor (*24*), considers the role of technological change in displacing workers performing routine tasks and complementing workers performing non-routine tasks. An additional implication of this framework is that an increasing share of employment will be found in comparatively low-skill non-routine manual tasks, that require situational adaptability, visual and language recognition, and in-person interactions but limited formal education, e.g., janitors and cleaners, home health aides, construction laborers, and security personnel. See Autor and Dorn (*25*) and Goos, Manning and Salomons (*26*) for evidence that employment in the U.S. and OECD has increasingly polarized into high-paid, abstract-intensive occupations and low-paid, manual-intensive occupations.

28. J. Tinbergen, *Kyklos* **27**, 217 (1974).

29. Details of this model are given in the Online Supplement.

30. D. Card, T. Lemieux, *American Economic Review* **91**, 97 (2001).

31. L. F. Katz, K. M. Murphy, *The Quarterly Journal of Economics* **107**, 35 (1992).

32. L. Katz, D. H. Autor, *Handbook of Labor Economics* **3**, 1463 (1999).

33. D. Card, T. Lemieux, *Quarterly Journal of Economics* **116**, 705 (2001).

34. D. H. Autor, L. F. Katz, M. S. Kearney, *Review of Economics and Statistics* **90**, 2 (2008).

35. E. Crivellaro, College Wage Premium Over Time: Trends in Europe in the Last 15 Years (2013).

36. Summarizing evidence on the college premium in 12 European countries betweeen 1994 and 1999, Crivellaro (*35*) finds a pattern of increasing skill differentials except in countries that have had a large increase in the relative supply of college graduates, a pattern consistent with the conceptual model laid out below.

37. While this deceleration is not evident from Figure 3, it is detected by the regression equation, as discussed in the Online Supplement.

38. The College Board, Trends in Student Aid: 2013, *Tech. rep.*, The College Board, New York (2013).

39. C. Avery, S. Turner, *Journal of Economic Perspectives* **26**, 165 (2012).

40. Three sources of uncertainty should be kept in mind when interpreting these estimates. First, they encompass substantial heterogeneity. While the average college graduate earns

substantially more than the average high school graduate, the least successful college graduates earn significantly below the median among high school graduates, and the most successful high school graduates earn substantially above the median among college graduates. Second, for students who acquire substantial student debt but do not complete the college degree, it is far from certain that college will prove a good investment. Finally, these calculations assume that the lifetime profile of earnings observed in the year of college graduation will persist throughout the career. As Figure 3 indicates, this premium has changed substantially over time, so this assumption is only a rough approximation. However, the college premium is so high at present that even with a substantial decline, college would remain an attractive financial proposition on average from a lifetime earnings perspective.

41. R. J. Murnane, *Journal of Economic Literature* **51**, 370 (2013).

42. D. Acemoglu, J. Robinson, *Why Nations Fail* (Crown Publishing, New York, 2012).

43. As with cross-sectional inequality, there is no economically 'ideal' level of intergenerational mobility. Even in a society with perfect equality of opportunity, one would expect children of successful parents to have above average success as adults, simply because many attributes that contribute to success (appearance, intellect, athleticism) are partly heritable.

44. M. Corak, *Journal of Economic Perspectives* **27**, 79 (2013).

45. S. F. Reardon, *Whither Opportunity*, G. J. Duncan, R. J. Murnane, eds. (Russell Sage Foundation, 2011).

46. R. Chetty, N. Hendren, P. Kline, E. Saez, N. Turner, Is the United States Still a Land of Opportunity? Recent Trends in Intergenerational Mobility (2014).

47. C.-I. Lee, G. Solon, *Review of Economics and Statistics* **91**, 766 (2009).

48. Between 2002-03 and 2012-13, the sum of federal Pell Grants and loans for higher education increased by 105 percent, from 83 billion to 170 billion in constant 2012 dollars (*38, Table 1*).

49. C.-T. Hsieh, E. Hurst, C. I. Jones, P. J. Klenow, The Allocation of Talent and U.S. Economic Growth (2013).

50. D. H. Autor, D. Dorn, G. H. Hanson, *American Economic Review* **103**, 2121 (2013).

51. D. Card, T. Lemieux, W. Riddell, *Journal of Labor Research* **25**, 519 (2004).

52. B. T. Hirsch, *Journal of Economic Perspectives* **22**, 153 (2008).

53. A. S. Goldberger, *Economica* **46**, 327 (1979).

54. The extensive involvement of state and federal government in education at all levels also underscores the fact that the distribution of education and skills today is in no sense a 'free-market' outcome; it is a consequence of both individual and public choices.

55. The set of countries is determined by the availability of consistent earnings data from the OECD. I focus on male full-time workers because comparisons that pool both genders are complicated by the rising labor force participation rates of women. Nevertheless, the patterns are qualitatively similar when both males and females are included.

56. The figure also highlights that the U.S. had substantially higher earnings inequality than many other developed countries even prior to the last three decades of expanding inequality.

57. D. Card, J. E. J. DiNardo, *Journal of Labor Economics* **20**, 733 (2002).

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60. Household incomes are measured with IRS tax data. College attendance is determined by whether an IRS Form 1098-T Tuition Statement (filed directly by colleges for each enrolled student) is submitted for a child in the calendar year in which she turns 19.

61. S. Machin, J. Van Reenen, Inequality: Still Higher, But Labour's Policies Kept it Down, *Tech. rep.*, Centre for Economic Performance, London (2010).

62. **Acknowledgments**: I am grateful to Daron Acemoglu, Lawrence Katz, John Van Reenen, Marika Tatsutani, two anonymous referees, and the Editor of this journal for valuable comments and advice, and to Christina Patterson and Brendan Price for expert research assistance. I acknowledge funding from the National Science Foundation (grant SES-1227334), the Russell Sage Foundation (grant 85-12-07), and the Alfred P. Sloan Foundation (grant 2011-10-12). All data and code that are unique to this article (Figures 1, 3A, 3B, 6A, 6B, S2) are available from the author. All other figures (2, 4, 5A, 5B, S1, S3A, S3B) are reproduced from other publications, as noted, with permission of the authors.

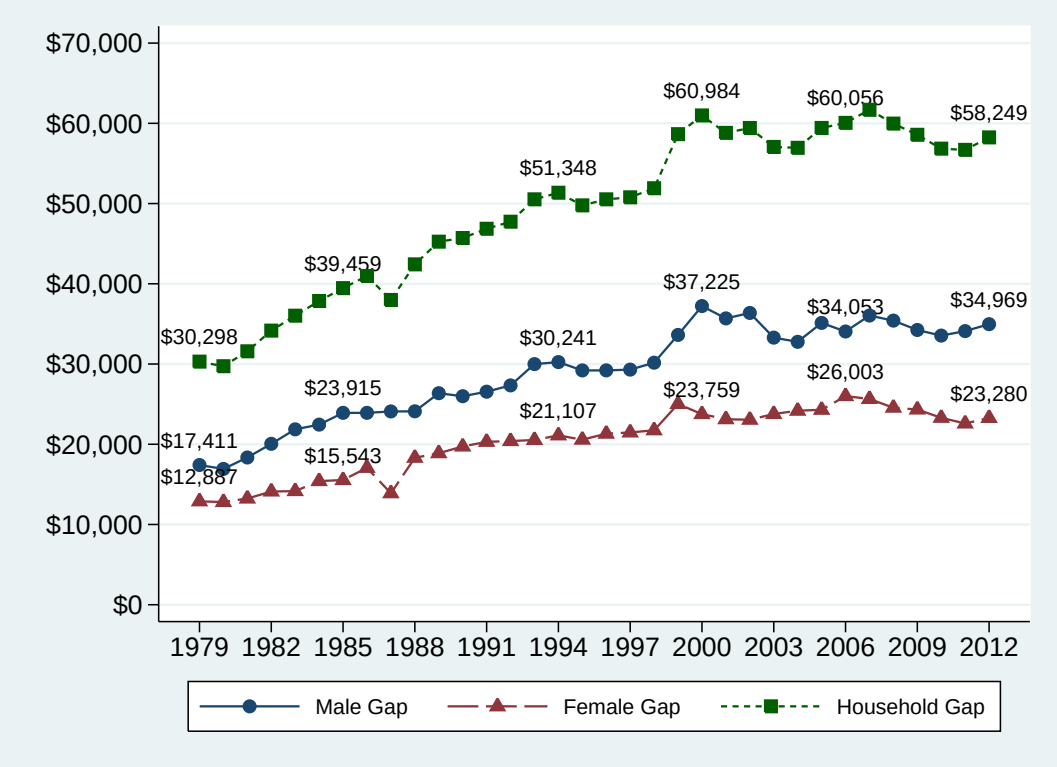

Fig. 1: College/High-School Median Annual Earnings Gap, 1979-2012. Notes: Figure is constructed using Census Bureau P-60 (1979-1991) and P-25 (1992-2012) tabulations of median earnings of full-time, full-year workers by educational level and converted to constant 2012 dollars (to account for inflation) using the CPI-U-RS price series. Prior to 1992, college-educated workers are defined as those with 16 or more years of completed schooling and high-school educated workers are those with exactly 12 years of completed schooling. After 1991, college-educated workers are those who report completing four-plus years of college and high-school educated workers are those who report having completed a high school diploma or GED credential.

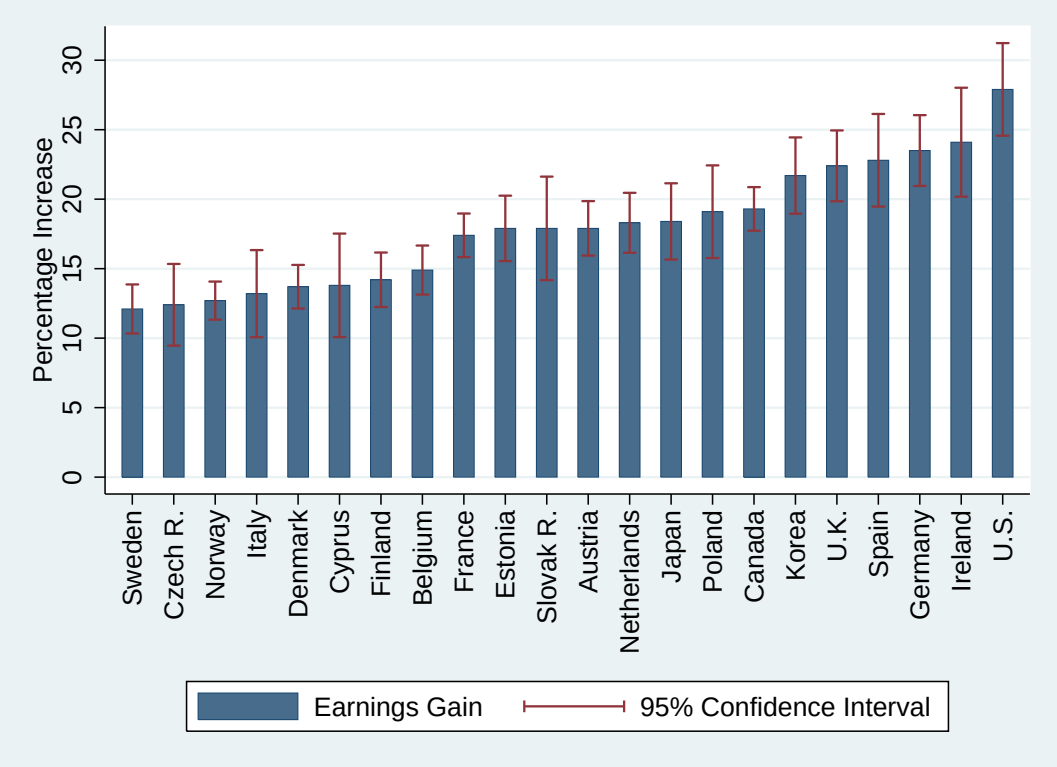

Fig. 2: Cross-National Differences in the Wage Returns to Skills, 2011-2013. Notes: Reproduced with permission from Hanushek et al. (*15, Table 2*). Estimates are obtained by regressing the natural logarithm of workers' weekly full-time earnings on test scores while controlling for sex and labor market experience (both a linear and a quadratic term). Regression estimates are performed separately for each country and test scores are normalized with mean zero and unit standard deviation within each country. Estimates that normalize test scores on a common basis across countries, or that use literacy or problem-solving scores rather than numeracy scores, yield qualitatively similar patterns.

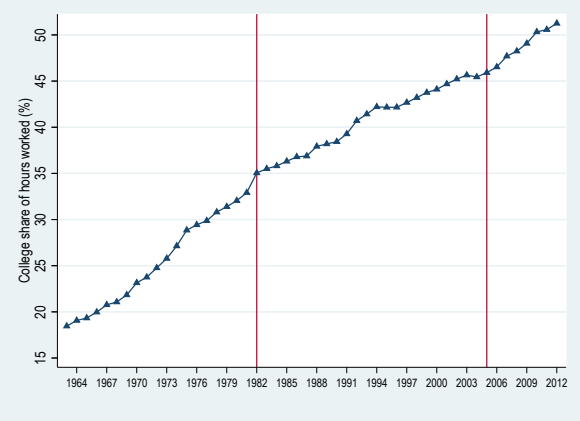

Fig 3A: College Share of Hours Worked in the U.S. 1963-2012: All Working Age Adults. Notes: Figure uses March CPS data for earnings years 1963-2012. The sample consists of all persons aged 16-64 who reported having worked at least one week in the earnings years, excluding those in the military. Following an extensive literature, college-educated workers are defined as all of those with four or more completed years of college plus half of those with at least one year of completed college. Non-college workers are defined as all workers with high school or less education, plus half of those with some completed college education. For each individual, hours worked are the product of usual hours worked per week and the number of weeks worked last year. Individual hours worked are aggregated using CPS sampling weights.

Fig. 3B: The U.S. College Premium and the Supply of College Graduates, 1963-2012. Notes: Figure uses March CPS data for earnings years 1963-2012. The series labeled "Measured Gap" is constructed by calculating the mean of the natural logarithm of weekly wages for college graduates and non-college graduates, and plotting the (exponentiated) ratio of these means for each year. This calculation holds constant the labor market experience and gender composition within each education group. The series labeled "Predicted by Supply-Demand Model" plots the (exponentiated) predicted values from a regression of the log college/non-college wage gap on a quadratic polynomial in calendar years and the natural logarithm of college/non-college relative supply. See text and the Online Supplement for further details.

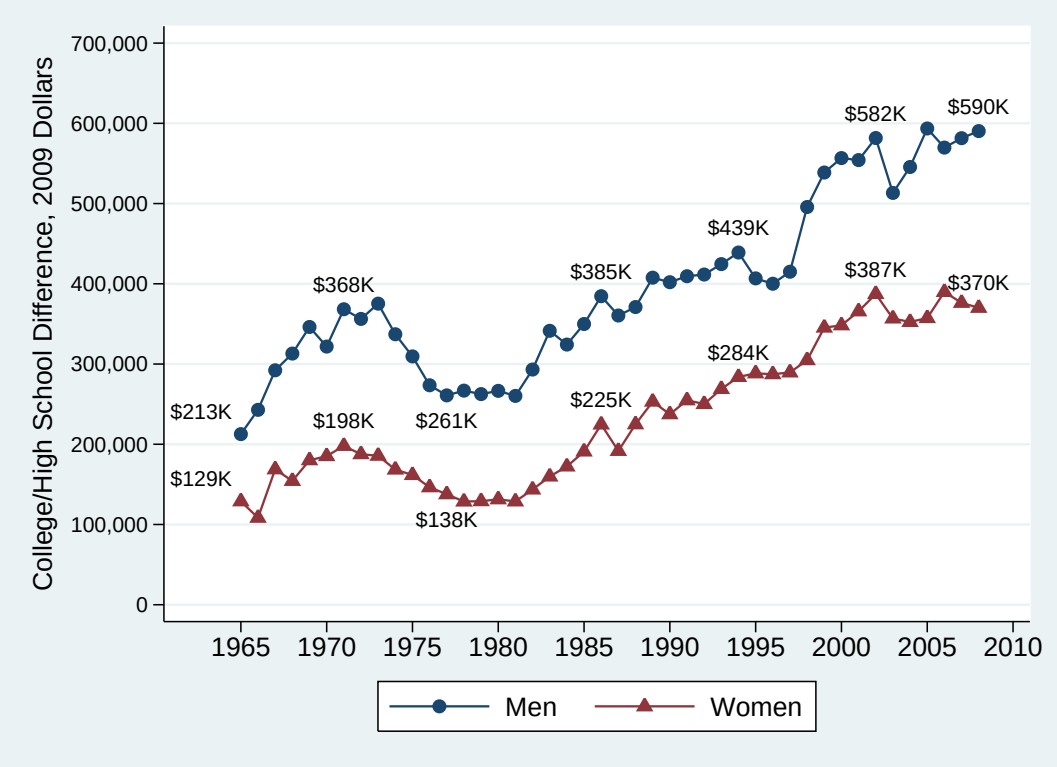

Fig 4: Present Discounted Value of College Relative to High School Degree Net of Tuition, 1965-2008. Notes: Reproduced with permission from Avery and Turner (*39*). Expected earnings are calculated from the March Current Population Survey files for full-time, full-year workers using sample weights. The estimates equal what a man or woman would expect to earn working full time, full year over a career of 42 years, with a discount rate of 3 percent, assuming that college graduates delay the start of earnings for four years while in school. Earnings expectations are formed in each year by assuming that future high school and college graduates will have future earnings at each age equal to the average earnings of high school and college graduates (respectively) presently observed at each age; for example, expected earnings in 1980 are based on data across ages for 1980. Results for college-educated workers are net of four years of tuition and fees associated with appropriate year-specific values for public universities. Plotted points show the difference between expected earnings for college graduates and for high school graduates.

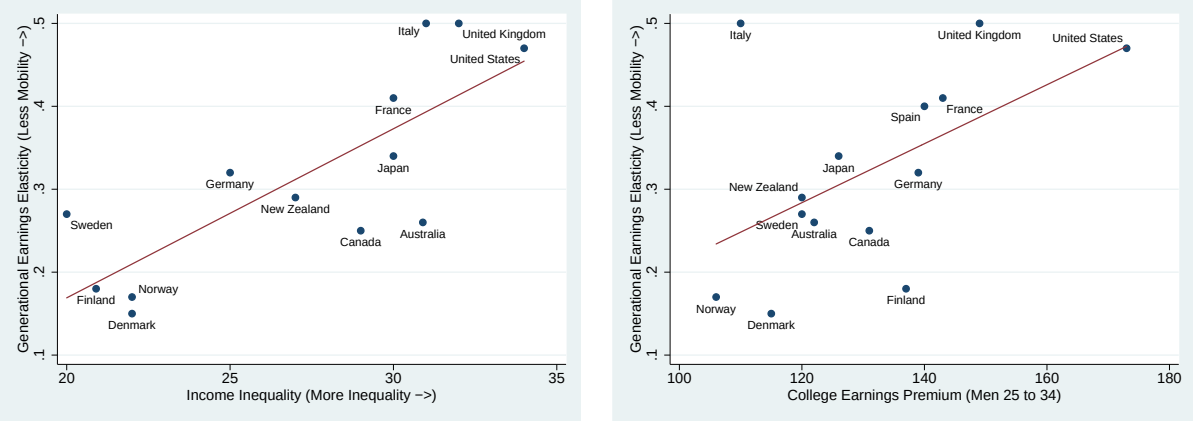

Fig 5: Title: "Earnings Inequality and Economic Mobility: Cross-National Relationships." Notes: Reproduced with permission from Corak (*44, Figures 1 and 4*). In both panels, the mobility measure is equal to the intergenerational earnings "elasticity," meaning the average proportional increase in a son's adult earnings predicted by his father's adult earnings measured approximately three decades earlier. A higher intergenerational earnings elasticity therefore implies lower intergenerational mobility. In the lefthand panel, cross-sectional income inequality is measured using a "Gini" index that ranges from zero to one-hundred, where zero indicates complete equality of household incomes and one-hundred indicates maximal inequality (all income to one household). In the righthand panel, the college earnings premium refers to the ratio of average earnings of men 25 to 34 years of age with a college degree to the average earnings of those with a high school diploma, computed by the OECD using 2009 data. See Corak (*44*) for further details.

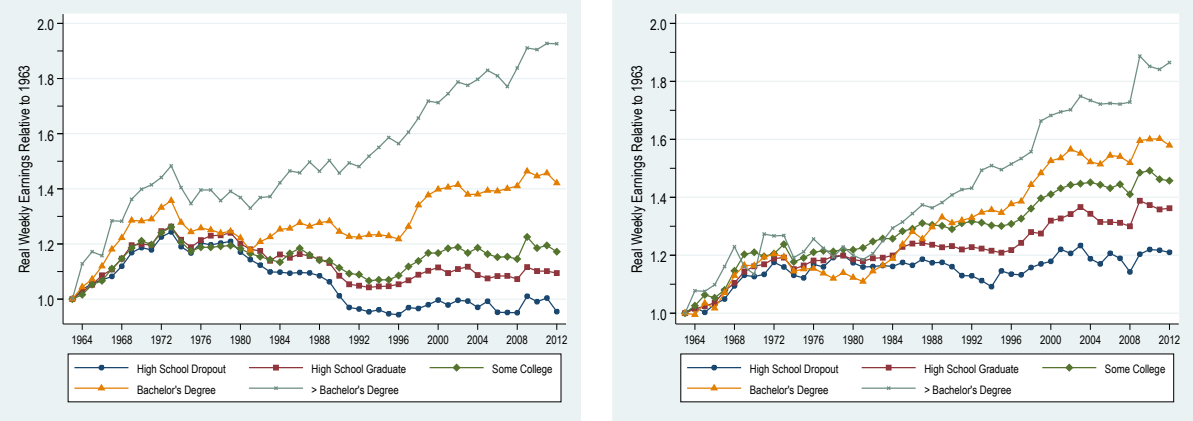

Fig 6: Title: "Change in Real Wage Levels of Full-Time Male (Panel A) and Female (Panel B) Workers by Education, 1963 - 2012." Notes: Data and sample construction are as in Figure 3.

Online Supplement: Skill Demands, Education and the Rise of Earnings Inequality among the "Other 99 Percent"

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Supplementary Materials:

- Supplementary Text
- Figures S1-S3
- References 55-61

Inequality in OECD Countries

The median earnings comparisons in Figure 1 convey a key feature of rising inequality that cannot be inferred from trends in top incomes: wage inequality has risen throughout the earnings distribution, not merely at top percentiles. Figure S1 documents this pattern by plotting for twelve OECD countries over three decades (1980 - 2011) the change in the ratio of full-time earnings of males at the 90th percentile relative to males at the 10th percentile of the wage distribution (*55*). The numbers overlaying each bar correspond to the 1980 level of the earnings ratio. While the 90/10 earnings ratio differs greatly across countries at the start of the sample—from a low of 2.0 in Sweden to a high of 3.6 in the United States—this earnings ratio increased substantially in all but one of them (France) over the next thirty years, growing by at least 25

percentage points in 10 countries, by at least 50 percentage points in 8 countries, and by more than 100 percentage points in three countries: New Zealand, the U.K. and the U.S. (*56*).

Changes in College Supply among Young Workers (0 - 9 Years of Potential Experience)

From 1963 through 1982, the fraction of all U.S. hours worked supplied by college graduates rose by almost one percentage point per year, a remarkably rapid gain. After 1982, however, the rate of inter-cohort increase fell by almost half—from 0.87 percentage points to 0.47 percentage points per year—and did not begin to rebound until 2004, nearly two decades later. This deceleration in the supply of college graduates is particularly stark when we focus in Figure S2 on young adults with fewer than ten years of experience—that is, the cohorts of recent labor market entrants at each point in time. While the supply of young college-educated males relative to young high school-educated males increased rapidly in the 1960s and early 1970s—and indeed throughout the post-war period—this rising tide reached an apex in 1974 from which it barely budged for the better part of the next 30 years. Among young females, while the deceleration in supply was not as abrupt or as complete as for males, it is also unmistakable.

Details of Supply-Demand Estimation Used in Figure 3

The supply-demand model in the lower panel of Figure 3 is estimated by fitting an OLS regression where the dependent variable is the natural logarithm of the college/high-school wage premium, the supply measure is the natural logarithm of college/non-college relative supply, and the model includes an intercept and a linear and quadratic term in calendar years (where the year 1963 is coded as 1):

$$\begin{aligned}\ln\left(w_{c,t}/w_{hs,t}\right) &= -0.213\,(0.097) + 0.031\,(0.005) \times (t-1962) - 0.000144\,(0.000042) \times (t-1962)^2 \\ &- 0.588\,(0.092) \times \ln\left(S_{c,t}/S_{hs,t}\right) + e_t,\, n = 50,\; R^2 = 0.95,\end{aligned}$$

where w_c and w_{hs} are the composition adjusted weekly wages of college and high-school graduates respectively, S_c and S_{HS} are the composition adjusted supplies, the subscript t denotes the year of each observation (1963-2012), e_t is an error term, and standard errors are given in parentheses. The positive linear and negative quadratic time trend terms implies that demand for college graduates is rising at a decreasing rate over time. The coefficient of -0.588 on the supply term captures the inverse elasticity of substitution between college and high-school workers, and implies an elasticity of 1.7, which is consistent with a large literature. An unresolved question in the literature on U.S. inequality is why the growth rate of demand for college workers apparently slowed after the mid-1990s (*34, 57, 58*).

Measures of Economic Mobility in the United States

Figure 5 in the text lends credence to the concern that rising inequality can erode economic mobility. As noted in the text, the evidence to date suggests that this erosion has not occurred. Figure S3, sourced from Chetty et al. (*46*), summarizes this evidence using two metrics of U.S. income mobility that are available for different time intervals. The left-hand panel plots the mean percentile income rank of children at ages 29-30 (y-axis) versus the percentile rank of their parents (x-axis) for three birth cohorts, 1971-74, 1975-78, and 1979-82 (*59*). The right-hand panel plots the percentage of children enrolled in college at age 19 (y-axis) vs. the percentile income rank of their parents (x-axis) for three more recent birth cohorts, 1984-87, 1988-90, and 1991-93 (*60*). We focus on college-going in the second panel because it is a strong predictor of adult earnings that is available prior to adulthood (note that the youngest cohorts in Figure S3 were only age 20 in 2013). Both panels demonstrate substantial economic *immobility* in the United States. The left-hand panel indicates that children born three deciles apart in the household income distribution are on average one decile apart in the earnings distribution at age 29-30. The right-hand panel finds that children born three deciles apart in the household

income distribution differ by twenty percentage points in their probability of attending college at age 19 (relative to a mean of approximately 55 percent). Yet, these figures offer no evidence that mobility has appreciably changed among children born prior to the historic rise of U.S. inequality and those born afterward. As far as we can see so far, rising U.S. income inequality has not reduced intergenerational mobility.

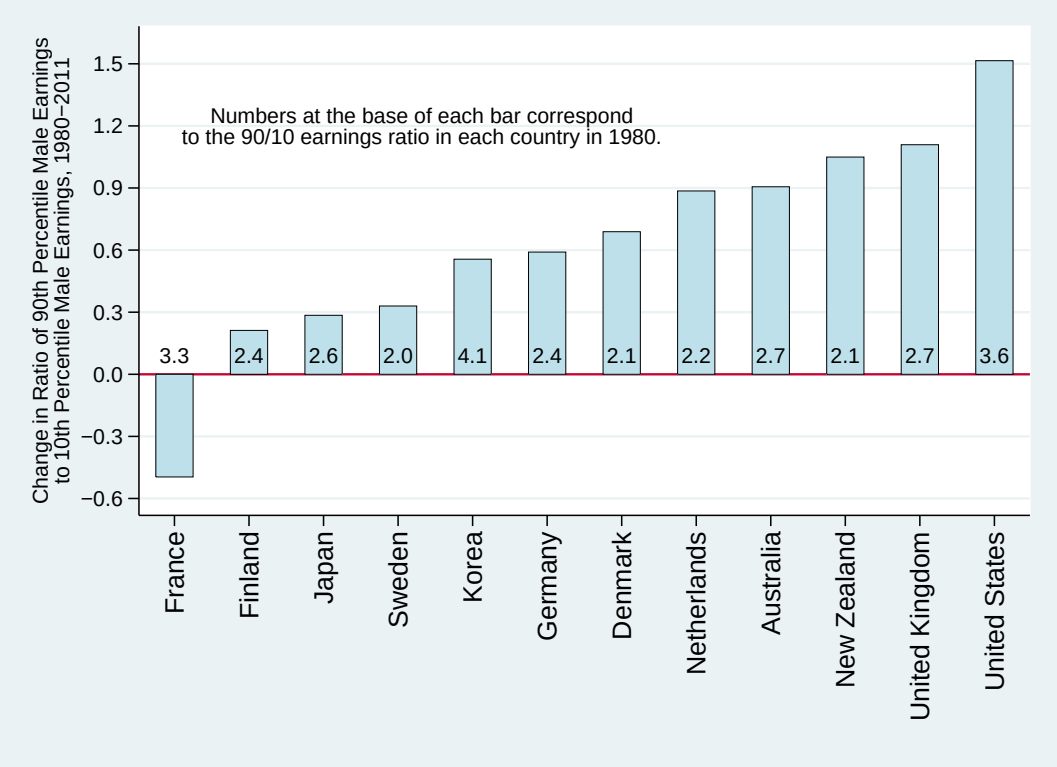

Fig. S1: Changes in the 90/10 Ratio of Full-Time Male Earnings Across Twelve OECD Countries, 1980-2011.

Notes: The bars show changes in the ratio of the earnings of full-time male workers at the 90th and 10th percentiles of the earnings distribution. The number accompanying each bar reports the earnings ratio as of 1980. For most countries, we compute the difference in the 90/10 ratio between 1980 and 2011 using data downloaded from OECD Stat Extracts. For New Zealand, the earliest data available are from 1984, so we compute this difference between 1984 and 2011 and multiply it by 31/27 to approximate the change over 1980-2011. For Denmark, France, Germany, and the Netherlands we use data from Machin and Van Reenen (*61*), scaling in similar fashion to approximate changes over 1980-2011.

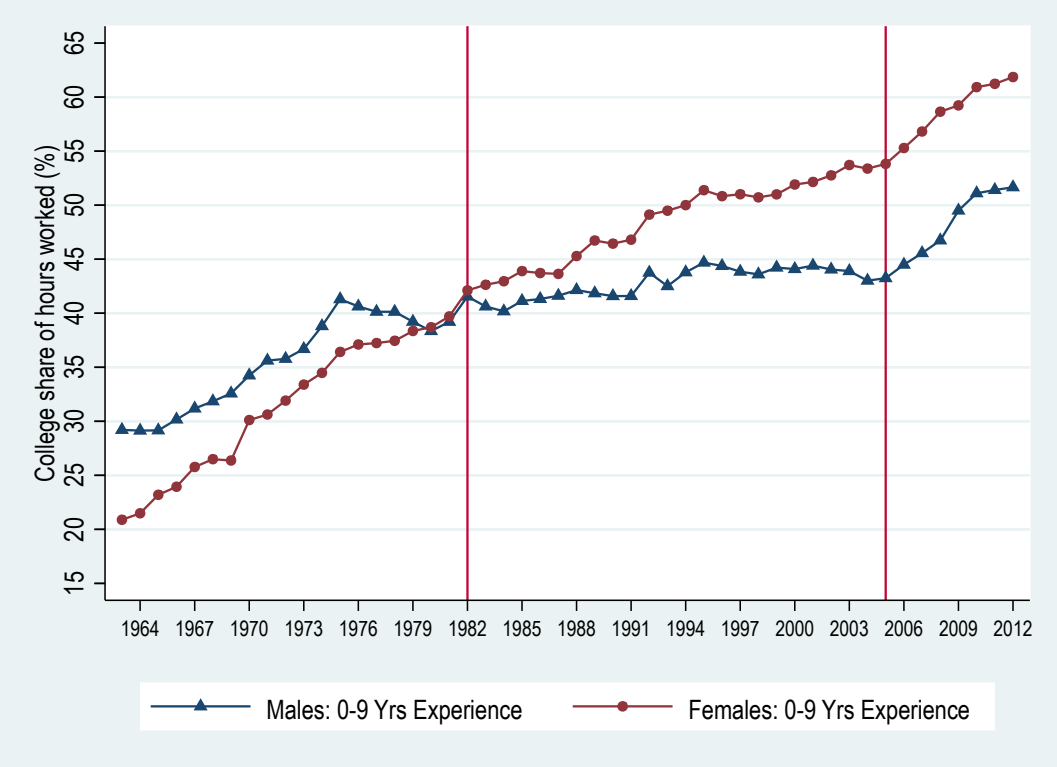

Fig. S2: College Share of Hours Worked in the U.S. 1963-2012: Recent Entrants.

Notes: Figure uses March CPS data for earnings years 1963-2012. The sample consists of individuals aged 16 or greater with fewer than 10 years of potential experience, where the number of years of potential experience is calculated by subtracting the number six (the normal age at school entry) and the number of years of schooling from the age of the individual. This number is further adjusted using the assumption that an individual cannot begin work before age 16 and that experience is always non-negative. Following an extensive literature, college-educated workers are defined as all of those with four or more completed years of college plus half of those with at least one year of completed college. Non-college workers are defined as all workers with high school or less education, plus half of those with some completed college education. For each individual, hours worked are the product of usual hours worked per week and the number of weeks worked last year. Individual hours worked are aggregated using CPS

sampling weights. The college share of hours worked is computed and plotted separately for men and women.

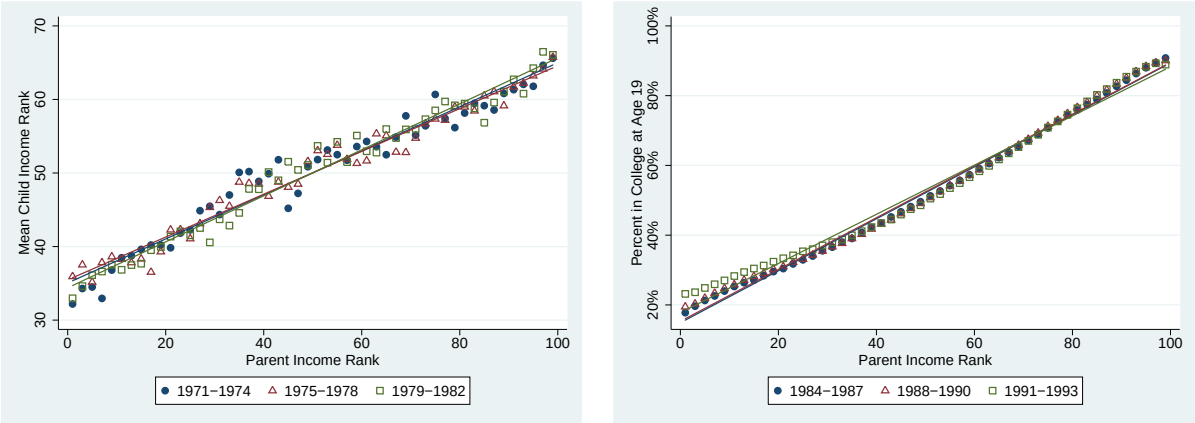

Fig. S3: Two Measures of Economic Mobility

Notes: Reproduced with permission from Chetty et al. (*46*). The lefthand panel plots the mean percentile income rank of children at ages 29-30 against the percentile rank of their parents for three groups of birth cohorts (1971-1974, 1975-1978, and 1979-1982). Parents are ranked into 50 two-percentile point bins. The righthand panel plots children's rates of college attendance at age 19 against parental income ranked in the same fashion, using three more recent sets of birth cohorts (1984-1987, 1988-1990, and 1991-1993). See Chetty et al. (*46*) for additional details.