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How have inequalities in educational spending in the United States evolved over the past five decades?

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Overview

Are educational spending in the US more or less equally distributed than in the past ? This briefs aims to describe the concentration of investments in education both for K-12 and for higher education in the US from 1970 to 2017. Even if the distribution of education spending is less unequal than the one of income or even wages, these spending are still very unequally distributed and, like for income and wages, inequalities have significantly increased over the past four decades, due to spending in higher education. Indeed, the top 10% of students for whom the most is spent used to have 28% of the total amount of instructional expenditure in higher education in 1970 and now have more than 36%.

Inequalities in educational investments are coming from two sources: unequal length of studies and unequal spending per grade, the latter being the main driver of the concentration observed. As a matter of fact, if everyone were to have the same educational attainment, the level of inequalities would almost be the same. The only way to reduce significantly the concentration of spending on education would be to equalize spending within each grade across districts and universities.

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All over the world, education has long been considered as a means of guaranteeing equality of opportunities by allowing fair and equitable access to prestigious schooling and professions to those successful in their educational career. Education is regarded as one of the most powerful instrument for reducing income inequality. This vision is particularly important in the US, considered as a land of opportunities . Nowadays this myth is highly debated and controversial. An enormous literature has shown inequalities in educational access depending on social origins, gender, race or place of residence. For instance, Chetty et al. [2017] showed that children in the top 1% of the income distribution are 77 times more likely to attend an Ivy League college than those in the bottom income quintile. There is thus a gap between the meritocratic ideal and the reality of the educational system.

In this brief, I focus on educational inequalities, not through the lens of social origins but through economic inequalities: not the same amount of money is invested in everyone's education. What are the economic inequalities produced by an institution that includes equality in its principles?

Investments in education represent a fair amount of public spending. In the US, they represented 6.7% of GDP in the 1970's and 7.1% of GDP nowadays. Its distribution among individuals is a high stake as it is likely to condition future inequalities within a cohort. Following the study of Piketty (Piketty [2013]) on the evolution of the concentration of income and wealth during the twentieth century, I study the concentration of educational expenditure, examining the percentage of expenditure going to the most favored 1%, 5% and 10% of individuals. Focusing on costs of schooling is also an impartial way to make comparisons, over time, over different areas and between several levels of education.

K-12 Education

The data used for K-12 education is the Annual Survey of State and Local Government Finances that contains information about school district enrollment and expenditure from 1970 to 1986 and the CCD School District Finance Survey from the National Center for Education Statistics from 1987 to 2016 where per pupil spending per district are directly available.

For elementary and secondary education, I observe that if, over the period, per pupil spending have more than doubled in real term, the level of inequalities for one year of K-12 education has stayed almost the same with the top 1% having 3% of the spending, the top 10, 20%, the bottom 50, 40% and the bottom 10, 7% approximately. A small decline in the concentration of educational investments from 1967 to 2000 is observed, date when this concentration starts to increase again so that over the entire period, the level of inequalities in these spending doesn't change much.

The level of inequalities for one year of K-12 education has stayed almost the same from 1970 to 2016.

Table 1 - Evolution of per pupil expenditure for one year of K-12 education and shares dedicated to each subgroups from 1970 to 2016 in constant 2017 dollars

	1970	1995	2016	Evolution
Mean spending	$5,708	$8,761	$11,833	+144%
Top 0.5%	$15,975 2.31%	$19,815 1.33%	$28,041 1.63%	+131%
Top 1%	$13,842 3.65%	$17,950 2.40%	$25,563 2.76%	+148%
Top 10%	$7,954 18.5%	$12,307 14.4%	$17,196 18.7%	+161%
Bottom 50%	$5,367 37.0%	$8,108 40.1%	$10,481 38.3%	+131%
Bottom 10%	$3,586 5.44%	$6,435 6.86%	$8,488 6.48%	+162%

Reading: In 2016, the top 10% of students for whom the most is spent have spending above $17,196 per year, they have 18.7% of the overall spending.
Sample: 1967-2016 School Districts.
Source: Historical Finances of Individual Governments (IndFin) for 1970 and Public Elementary-Secondary Education Finance Data for 1995 and 2016, US Census Bureau.

Growth incidence curves show the growth occurred at

each percentile of the distribution of spending for K-12 education. From 1972 to 2016, a U-shaped pattern is observed with most of the growth in spending occuring at the bottom and at the top of the distribution of spending (Figure 1). Percentiles below the 30th percentile and above the 75th percentile have increased spending by more than 100%. This evolution in fact reflects two very different evolutions over time with a decrease in the concentration of spending from 1972 to 2000 –presumably under the influence of school finance reforms– and an increase in the concentration of spending from 2000 to 2016 as the most spending percentiles have known the biggest increase in per pupil spending.

Higher Education

The data used for higher education is from IPEDS (Integrated PostSecondary Education Data System). I compute per student spending based on instructional expenditure and fall total enrollment. I also computed results based on other definitions of expenditure: average total expenditure including part of research fundings but excluding hospital expenditure and independent operations of universities, spending per student without grants, spending per student with grants, averate public expenditure per student...

Spending on higher education are far more unequally distributed than in K-12 education and inequalities in higher educational spending have increased over time.

Spending on higher education are far more unequally distributed than in K-12 education and inequalities in higher educational spending have increased over time (Table 2). For one year of higher education, the top 1% of students for whom the most is spent have 11% (compared to 7.0% in 1980) of the overall instructional spending. Average student spending have increased by 85% in real terms but this figure conceals huge disparities: spending for the top 1% have increased by 175% and spending for the median student have only increased by 50%. These figures concern only one year of education and do not take into account the fact that some people are not going to university. Results taking into account the length of studies are even more unequal as colleges that are big spenders also tend to be those where students stay enroll longer.

Table 2 - Evolution of per student expenditure for instruction for one year of higher education and shares dedicated to each subgroup from 1980 to 2017 in constant 2017 dollars (students only) [1]

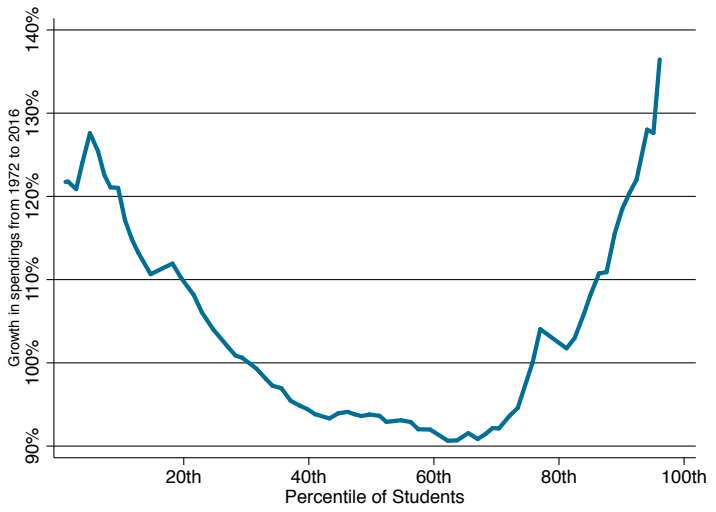
	1980	2000	2017	Evolution
Number of institutions	2,619	4,565	6,411	+145%
Mean spending	$4,825	$7,171	$8,919	+84.8%
Top 0.5 %	$27,790 4.61%	$52,675 6.44%	$85,767 6.45%	+208%
Top 1 %	$19,392 6.94%	$39,711 9.30%	$53,346 10.55%	+175%
Top 10 %	$8,113 27.69%	$12,608 34.20%	$16,172 36.25%	+99.3%
Bottom 50 %	$3,938 25.54%	$5,108 22.54%	$5,882 20.28%	+49.3%
Bottom 10 %	$1,716 2.97%	$2,287 2.65%	$2,561 2.15%	+49.2%

Reading: In 2017, the top 10% of students for whom the most is spent have instructional spending above $16,172, they have 36.25% of the overall spending. ***N.B.:*** The analysis only concerns people going to higher education, it doesn't take into account that a big proportion of a cohort doesn't go to university and doesn't receive any investment in higher education. The analysis only takes into account instructional expenditure and not spending for research, student services, public services, academic support and institutional support. ***Sample:*** 1980, 2010 and 2017 colleges and universities. ***Source: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment Data.***

Taking into account people excluded from higher education (Table 3), the increase in the concentration of investments in higher education is more tenuous as the higher level of concentration is compensated by the fact that more people have access to university. This doesn't

[1] The evolution of the distribution of spending based on a constant coverage of institutions (2,478 institutions are present all over the period) is of the same order of magnitude than the one with all institutions present in the data. The increase in inequalities observed at the higher education level is thus not only due to the arrival of new institutions like for-profit institutions for instance.

Figure 1. Growth incidence curve of per pupil spending between 1972-2016



Reading: Between 1972 and 2016, per pupil spending for those at the 80th percentile of the distribution of spending increased by slighlty more than 100%. *Sample:* 1972 and 2016 School Districts. *Source*: Historical Finances of Individual Governments (IndFin) for 1972 and Public Elementary-Secondary Education Finance Data for 2016, US Census Bureau.

take into account that not all students graduate from university, something I study in the next section about the entire educational career.

Table 3 - Evolution of instructional expenditure for one year of higher education and shares of per individual instructional expenditure from 1980 to 2017 in constant 2017 dollars (all individuals)

	1980	2000	2017	Evolution
Mean spending	$1,771	$2,735	$5,075	+186%
Top 0.1 %	$33,040 3.29%	$79,818 4.16%	$118,428 2.53%	+258%
Top 0.5 %	$17,195 8.05%	$37,553 10.26%	$66,670 9.66%	+287%
Top 1 %	$14,276 12.92%	$26,747 15.39%	$41,989 14.68%	+194%
Top 10 %	$5,508 47.77%	$8,415 47.50%	$12,674 48.34%	+130%
Bottom 50 %	$0 0%	$0 0%	$2,694 2.75%	$+\infty$%

Reading: In 2017, the top 10% of individuals for whom the most is spent have spending above $12,674, they have 48.34% of the overall spending.

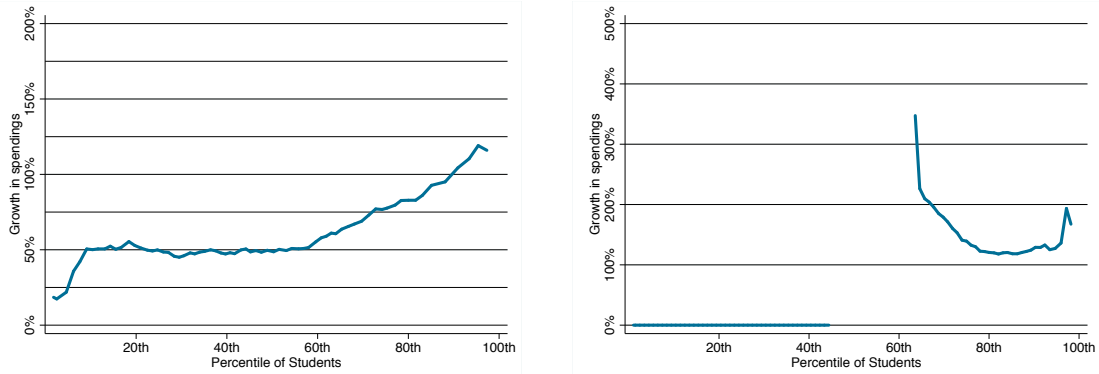
N.B.: The analysis takes into account that a big proportion of a cohort doesn't go to university and doesn't receive any investment in higher education, explaining a mass point at 0. The analysis only takes into account instructional expenditure and not spending for research, student services, public services, academic support and institutional support. ***Sample:*** 1980, 2000 and 2017 colleges and universities. ***Source: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment Data.***

The growth incidence curve (Figure 2) focusing on the population of college-goers shows an increase all along the distribution of spending: the highest percentiles of spending have known the biggest increase over the period. Focusing on all individuals, no evolution is seen for the first 45th percentiles of the distribution as these individuals are not going to university. The biggest increase comes from the middle of the distribution as this is individuals that used to have zero spending and now have access to higher education. The curve then has a U-shapped pattern.

Total educational career

Not having individual data, I don't know where have studied those having longer studies. In this section, I

Figure 2. Growth incidence curve of per student higher educational spending for instruction between 1980 and 2017



(a) Students only **(b)** All individuals

Reading: Between 1980 and 2017, per student spending for those at the 60th percentile of the distribution of spending increased by around 50%. *Sample:* 1980 and 2017 Colleges and Universities. *Source*: IPEDS Enrollement and Finance Data in 1980 and 2017, NCES data for the proportion of college goers (Figure (b))

compute global inequalities in spending based on two hypotheses: the first one assumes that dropouts are uniformly distributed among all the deciles of spending. It means than among those who drop after 10th grade, 1% have been in the 1th percentile of spending, 1% in the 99th percentile of spending and so on. Inequality levels computed this way can be considered as lower bounds for inequalities in spending as the one getting the most expensive primary and secondary education are more likely to stay enroll longer in the educational system. The second hypothesis assumes that dropouts are concentrated among the lowest spending districts. It means that the 3.4% of students dropping after 8th grade in the 1970's are the 3.4 lowest deciles of spending, the 2.9% of students dropping after 9th grade in the 1970's are the 2.9 following lowest deciles of spending and so on. Then I match the college distribution to the highest spending deciles of K-12 education corresponding to the proportion of college goers. It can be considered as an upper bound for inequalities in spending. My first cohort studied is the 1964 cohort as individuals born this year are entering elementary education in 1970, when my data on spending per district starts continuously. My last cohort is the one entering first grade in 2005 as they reach higher eduction in 2017, the last year of my data. I don't take into account repeaters in K-12 education as I do not have data on repeaters per district but I do take into account different time to graduation between colleges for different degrees.

Length of studies in higher education

For the global longitudinal analysis, I take into account the length of studies. From 2005 and onward, information on graduation and completion rate per institution is available. I compute the average length of associate degree studies and bachelor studies per institution the following way:

$$Ass_{Li} = Drop_i*1+Grad_{2Yi}*2+Grad_{3Yi}*3+Grad_{4Yi}*4$$

$$Bach_{Li} = Drop_i*2+Grad_{4Yi}*4+Grad_{6Yi}*6+Grad_{8Yi}*8$$

With Ass_{Li} the average length of studies for an associate degree in a particular institution i, $Bach_{Li}$ for a bachelor degree, $Drop_i$ the proportion of dropout in institution i (as detailed information on length of study of dropouts is not available, I assume that dropouts of associate degree have 1 year of studies and dropouts of bachelor degree have 2 years) and $Grad_{nYi}$ the

proportion of students that take n years to graduate in institution i. In 2017, the mean dropout rate is 0.51 for bachelor studies (similar to 2005) and 0.41 for associate degrees. The average length of associate degree studies is 1.83 and bachelor studies is 3.35 years (it was 3.20 in 2005). Most students that do graduate take longer than 2 or 4 years but as many students dropout, the average length of studies is smaller than the length required to complete the degree.

For the length of master, as I do not have data on time to graduate for master students, I add two years to the average length of bachelor studies. For institutions with missing values for the length of studies, I impute the average of institutions belonging to the same decile of expenditure and to the same sector (Public less than 2-year, Public 2-year, Public 4-year, Private less than 2-year, Private 2-year, Private 4-year). For institutions that only report enrollment for undergraduate students globally but not specifying the proportion of associate degree and bachelor degree students, I infer values based on the proportion of these two types of students for the same kind of institutions (institutions belonging to the same decile of expenditures and to the same sector). As I do not have data on length of studies per institution prior to 2005, I use the 2005 coefficient for previous years weighting by the average completion rate – ratio of bachelor recipients to people receiving some college education – over time based on Bound et al. [2010].

Results with instructional expenditure

Overall, as expected given the fact that educational spending inequalities for K-12 education have stayed fairly stable and those for higher education have increased, shares dedicated to the top 10%, top 1% and top 0.5% seem to have increased over time whereas the one of the bottom 50 has slightly decrease (Table 4). The top 10 used to have between 18.6% (hypothesis 1) and 20.0% (hypothesis 2) in the 1970's and has between 22.2% and 23.5% in the 2000's. The bottom 50 used to have between 36% (hypothesis 2) and 37.3% (hypothesis 1) in the 1970's and has between 34.2% and 35.3% in the 2000's.

Table 4 - Shares and average amounts of educational spending for the entire educational career

	1970 cohort - instructional expenditure			
	Hypothesis 1		Hypothesis 2	
Mean spending		$83,584		$83,584
Top 0.1 %	0.99%	$370,264	1.09%	$396,463
Top 0.5 %	2.35%	$242,658	2.55%	$259,807
Top 1 %	3.66%	$197,081	3.97%	$220,148
Top 10 %	18.6%	$114,778	20.0%	$122,897
Bottom 50 %	37.3%	$75,952	36.0%	$75,045
Bottom 10 %	5.69%	$52,871	4.53%	$46,306
	1998 cohort - instructional expenditure			
	Hypothesis 1		Hypothesis 2	
Mean spending		$145,294		$145,294
Top 0.1 %	0.82%	$829,954	0.99%	$1,040,319
Top 0.5 %	2.70%	$523,762	2.93%	$539,865
Top 1 %	4.35%	$407,069	4.60%	$416,777
Top 10 %	20.8%	$203,104	22.0%	$217,043
Bottom 50 %	36.8%	$118,312	35.7%	$117,583
Bottom 10 %	6.08%	$96,098	5.41%	$98,070
	2005 cohort - Instructional expenditure			
	Hypothesis 1		Hypothesis 2	
Mean spending		$157,726		$157,726
Top 0.1 %	0.95%	$1,093,674	1.13%	$1,214,180
Top 0.5 %	3.03%	$619,547	3.27%	$639,052
Top 1 %	4.77%	$482,163	5.05%	$487,009
Top 10 %	22.2%	$237,344	23.5%	$249,557
Bottom 50 %	35.3%	$126,777	34.2%	$125,446
Bottom 10 %	5.87%	$101,762	5.39%	$101,878

Reading: Among individuals entering first grade in 1970, the bottom 50 percent of individuals having the lowest spending had spending between $75,045 (hypothesis 2) and $75,952 (hypothesis 1) all over their educational career. They had between 36% and 37.3% of the overall spending.
N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditure only.

Source: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for higher education.

Nevertheless, the one of the bottom 10 has slighlty in-

creased: they used to have between 4.53% (hypothesis 2) and 5.69% (hypothesis 1) in the 1970's and have between 5.39% and 5.87% in the 2000's. This is consistent with the fact that higher education spending have increased the least for students located at the median of spending.

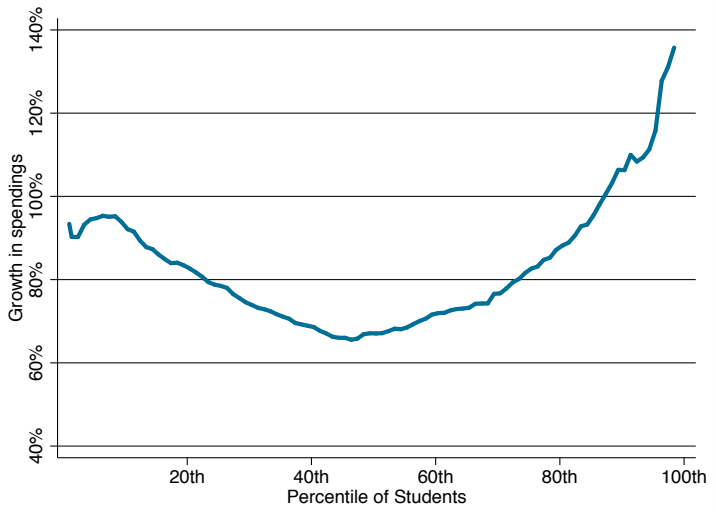
This is striking to observe than besides the big differences in the two hypotheses I made (people leaving eduacation early distributed uniformly among the different levels of spending or concentrated among the least spending deciles), the distributions are quite similar. As expected, when dropouts are concentrated in the least spending deciles, the distribution is more unequal as the same individuals have both less spending per year and less years of education. Nevertheless, the order of magnitude stay the same. This can be explained as there is an enormous variance in spending within each grade, and dropouts only concern a small fraction of the population (around 14% in the 1970's and around 10% in the 2000's). This matters certainly more through who are the one going to college but college education only represents between 1 and 6 years of schooling among a far longer educational career.

Comparison over time and different levels of education

Comparing the distribution of spending for K-12 and higher education reveals that the concentration in educational investments are not of the same order of magnitude at all (Figure 4). Focusing on shares dedicated to each groups (Bottom 50%, Top 10% and Top 1%), the share of the bottom 50 is around 40% of the overall spending in K-12 education (Figure 4 (a)), but is between 10% and 20% of the overall instructional spending for higher education considering only students (Figure 4 (c)) and is almost null for higher education considering the entire population (Figure 4 (d)). Conversely the share of the top 1% is around 4% of the overall investments in K-12 education against between 10% and 15% for higher education considering only students and between 15% and 20% considering the entire population.

As I mentioned in the introduction, inequalities are coming from two sources: not everyone has the same level of education and not everyone has the same spending per grade. The first inequality can, to some extend, be considered as "fairer" as it makes more sense to have higher ability students pursuing their studies longer – some authors showed that contrary to many others spending, optimal education spending can be anti-redistributive – (Arrow [1971]). To know what is the main source of inequality, it is interesting to decompose them: what would have been the level of inequalities in 1970 if the educational attainment was the one of 2005? And, what would have been the level of inequalities in 2005 if the educational attainment was the one of 1970? With this decomposition, levels of inequalities are really similar to those found in the main specification: having the level of educational attainment of 2005 in 1970 or of 1970 in 2005 would not change much in the distribution of spending. There is so much variance in spending per grade, that the overall level of educational attainment doesn't seem to play a big role. To explore further what is the role of global educational attainment on the distribution of spending, I study the distribution of spending if everyone were to attain the bachelor level. The only inequality that remains is through variance in spending per grade. Once again, the distribution of spending doesn't change much. Leveraging educational attainment with everyone having access to an undergraduate degree would not decrease a lot inequalities in spending as long as the variance per grade stays the same. If only inequality coming from different length of study remained but everyone were given the average spending in each of their grade (everyone in first grade has the average spending for one year of K-12 education, everyone in bachelor has the average spending for one year of bachelor, etc.), the levels of inequalities would be much smaller reinforcing the idea that the main inequality comes through variance in spending per grade.

Figure 3. Growth incidence curve of global educational spending from the 1970's to the 2000's



Reading: Between the 1970's and 2000's, per pupil spending for education increased by around 100% for those at the 90th percentile of expenditures. *N.B.:* Computations are made based on hypothesis 1 of combination of inequalities in K-12 and higher education. *Sample:* 1970-1981 and 2005-2017 school districts, 1980 and 2017 colleges and universities. *Source*: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for higher education.

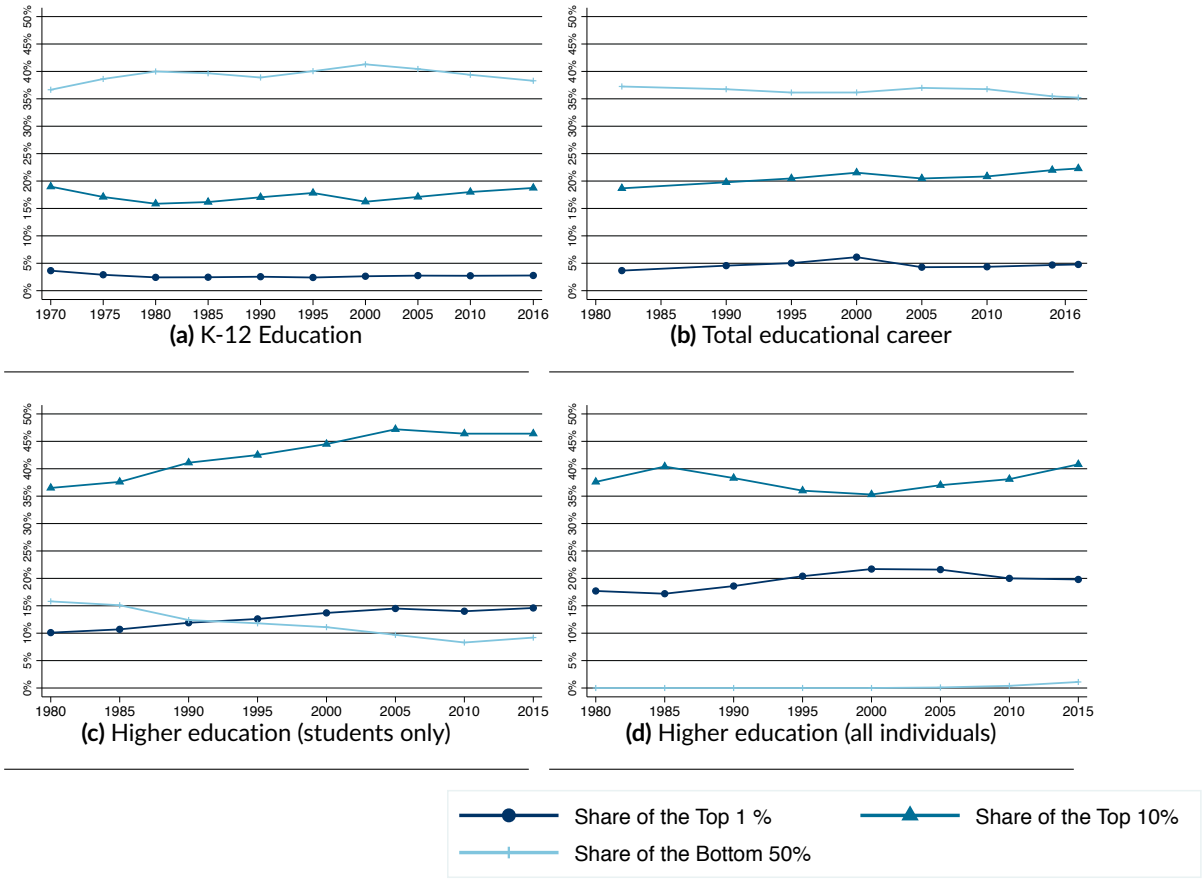
For the 2005 cohort, the top 10% would have 12.1% of spending (contrary to between 22.2% and 23.5%) and the bottom 50% would have between 46.3% and 46.5% (contrary to between 34.2% and 35.3%).

Leveraging educational attainment with everyone having access to an undergraduate degree would not decrease a lot inequalities in spending as long as the variance per grade stays the same.

Conclusion

This brief aimed at analysing the distribution of educational spending in the US from 1970 to 2017. For K-12 education, despite several school finance reforms that occurred since the 1970's, the level of inequalities in per pupil spending between districts at the national level has stayed remarkably constant. In higher education, the picture is totally different as instructional spending and several definitions of expenditure are far more concentrated. Contrary to what is observed for K-12 education, the concentration of spending for higher education among the subpopulation of college goers has increased a lot over the past four decades. Considering the entire population, investment in higher education are far more unequally distributed but the concentration of these investment have stayed remarkably constant, the increase in inequalities being compensated by the fact that more people have access to university nowadays than in the 1970's. At a global level, the level of inequalities has increased a little, but far less than for higher education alone. Inequalities in educational spending are mainly driven by the variance in spending per grade between districts and institutions rather than by the length of studies. The only efficient way to reduce inequalities in education spending would be to reduce the variance in spending within each grade as having everyone reaching the same degree would not change much in the concentration of educational investments. Even if causal analysis based on event

Figure 4. Evolution of the shares of the top 1, top 10 and bottom 50 of education spending for different levels of education from 1980 to 2015



Reading: For higher education considering only the subpopulation of students (c), the share of the top 1% of students for whom the most is spent in instructional spending have around 15% of the overall instructional spending in 2015. *N.B.*: (b) Computations are made based on hypothesis 1 of combination of inequalities in K-12 and Higher Education. (b), (c) and (d) Computations are made considering instructional expenditure for higher education only (research and other type of expenditures are excluded). *Source*: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education.

studies are essential to the understanding of changes in the educational system under the influence of educational policies and to understand what are the drivers of inequalities in education, they should not be a reason to forget about the global picture of what is happening in terms of the distribution of educational spending.

"While courts and legislatures have significantly changed the fiscal responsibilities for schools since the early 1970s, surprisingly little is known about the effects of these alteration. Some efforts have been made to track the spending patters of these changes, but less attention has gone to consideration of the overall level." (Hanushek [2002])

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The World Inequality Lab

The World Inequality Lab aims to promote research on global inequality dynamics. Its core mission is to maintain and expand the World Inequality Database. It also produces inequality reports and working papers addressing substantive and methodological issues. The Lab regroups about twenty research fellows, research assistants and project officers based at the Paris School of Economics. It is supervised by an executive committee composed of 5 co-directors. The World Inequality Lab works in close coordination with the large international network (over one hundred researchers covering nearly seventy countries) contributing to the database.

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