

THE CONCENTRATION OF EDUCATIONAL INVESTMENT IN THE US (1970-2018), WITH A COMPARISON TO FRANCE

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ABSTRACT

This study aims to analyse the concentration of educational investments in the US from 1970 to 2017, and to compare it to the concentration of the same investments in France. In the US, I study both the distribution of spendings for K-12 and Higher Education and then present different scenarios to combine both inequalities. Even if the distribution of educational spendings is less unequal than the one of income or even wages, these spendings are still very unequally distributed and, as for income and wages, inequalities have significantly increased over the past four decades, especially for higher education. Indeed, the top 10% of students for whom the most is spent used to have 28% of instructional expenditure in 1970 and now have more than 36%.

Inequalities in educational investments are coming from two sources: unequal length of studies and unequal spendings 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 in educational spendings would be to equalize spendings within each grade across districts and universities.

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“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 alterations. Some efforts have been made to track the spending patterns of these changes, but less attention has gone to consideration of the overall level.” (Hanushek [2002])

“Although there remains widespread disagreement about the relative importance of different explanations for the recent increase in inequality and the stubborn persistence of poverty, the role of labor market skills and workers’ education figures high on the list.” (Heckman et al. [2005])

“Contrary to the narrative of administrative bloat, spending cuts affect core instruction and academic support, generating large downstream impacts on educational attainment.” (Deming and Walters [2017])

“Only if our country faces the consequences of growing income inequality will it be able to maintain its rich heritage of upward social mobility through educational opportunity.” (Duncan and Murnane [2011])

INTRODUCTION

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 instruments for reducing income inequality. This vision is particularly important in the US, considered as a "land of opportunities" where everyone could achieve their dream through hard work and determination (Dhatt [2002]). Nowadays this myth is highly debated and controversial. Many studies have shown an enormous literature has shown inequalities in educational access depending on social origins, gender, race or place of residence (Heckman et al. [2005]; Bailey and Dynarski [2011]; Duncan and Murnane [2011]; Rothstein [2019], etc.). The most prestigious colleges and universities have mostly students coming from very favoured social backgrounds. For example, on average, Harvard students have parents in the top 2% of the US wage distribution, (Piketty [2013]). Children in the top 1% of the income distribution are 77 times more likely to attend an Ivy League college than those at the bottom income quintile (Chetty et al. [2017]). There is thus a gap between the meritocratic ideal and the reality of the educational system.

Many people thought that making high school and higher education accessible to the masses would reduce inequalities, the idea being that the different "school movement(s)" (Goldin and Katz [1997]) would allow any individuals with the same aptitudes to have access to the same education and thus to the same social position. Nevertheless, differences in educational attainment depending on social origins persist and even among people having the same level of education, there is a huge variety in the quality of the education received. Moreover, this variance in quality seems to have increased over time, at least for higher education (Hoxby [2009]).

The rationale behind public investment in education is centered around externalities created by education (with returns for the entire community in terms of growth, diminution of criminality for instance). Some part of education is considered as a quasi-public good –especially for low level of education–. Another part is considered as a private good: in higher education, private returns are high, justifying that a substantial part of educational investments are made privately through tuition or the opportunity cost of forgone wages. Regarding education as an investment dates back to the 17th century with writings of Petty [1769] and Smith [1776] (*"The acquisition of ... talents during ... education, study, or apprenticeship, costs a real expense, which is capital in [a] person. Those talents [are] part of his fortune [and] likewise that of society"*). It was brought into mainstream economics by Schultz [1961], Becker [1962] and Mincer [1970]. Theories of human capital show that educational expenditures are very likely to be important.

In this thesis, I focus on educational inequalities, not through the lens of social origins but through economic inequalities: in the sense that not the same amount of money is invested in everyone's edu-

education. Educational investments represent a fair amount of public spending –in the US, expenditures of educational institutions represented 71,575 million dollars in 1970, *i.e.* 6.7% of GDP and 1,293 billions dollars in 2015, *i.e.* 7.1% of GDP–. 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 during the twentieth century, I study the concentration of educational expenditures, examining the percentage of the expenditure going to the most favored 1%, 5% and 10% of individuals. Moreover, focusing on costs of schooling is interesting as it is an impartial way to measure and it is a good method of making comparisons, over time, of different areas and between several levels of education.

Over the past decades, a big increase in income inequalities is observed, particularly in the US (Piketty and Saez [2003]). Some authors (Goldin and Katz [2009]) argue that rising inequalities in the US can be explained by a "skill biased technical change" with the increase in demand for educated workers rising return to education since the 1980's. Indeed, between 1977 and 2007, the inflation-adjusted wage of college graduates grew by 25 percent, whereas that of high school graduates increased by only 1 percent, and that of high school dropouts fell by 13 percent (Levy and Murnane [2004]). Why then hasn't the supply of educated people adjusted to this technological bias on the labor market? Can inequalities in educational spendings account for this non-adjustment? On a descriptive perspective, we can wonder if education produces inequalities of the same "order of magnitude" as wage inequalities for instance. What are the economic inequalities produced by the institution that includes equality in its principles?

Moreover, it can be considered that "Money does matter" in education and that the quality of the education received won't be the same if someone received \$50,000 in the 1970's (in 2017 dollars) or \$100,000 in the 2010's (in 2017 dollars) –corresponding to spendings for individuals at the 10th percentile of spendings– or \$198,000 in the 1970's (in 2017 dollars) or \$485,000 in the 2010's (in 2017 dollars) –corresponding to spendings for 99th percentile of spendings– all along their educational career. There is a longstanding debate in the economics of education literature regarding the impact of more resources on educational outcomes. The Coleman report *Equality of Educational Opportunity* (Coleman [1966]) published by the US Government in 1966 conveyed the idea that money in education doesn't matter. This idea, often the only one remembered from the report, is going a little bit too far in its conclusion: indeed, it concluded that money need to be invested wisely and that more money by itself doesn't make better schooling outcomes (*«There appears to be no strong or systematic relationship between school expenditures and student performance»*, Hanushek [1986]). Nowadays, it's usually considered that money does matter and even so in deprived or segregated areas, especially when used to impact class size, which is, with teacher quality, the main driver of per pupil expenditure. Jackson et al. [2015] showed that increased per pupil spendings were associated with improved schooling outcomes using school finance reforms as exogeneous shifter of per pupil spendings.

Due to the particular nature of the American educational system, inequalities in educational spendings are coming from two sources:

- Length of studies: it costs more if you stay longer in school;
- Within the same grade, equal amounts of money are not invested into each person: it costs more if you are in a most expensive school or college.

The first inequality can to some extent be considered as "fairer" as on a social perspective, it makes more sense to allow individuals with higher abilities to pursue their studies longer. However, as I argued just before, the access to higher levels of studies and most selective curriculum is very socially determined.

In this master thesis, I try to evaluate these two inequalities in educational spendings and their evolution over time from the 1970's to the 2010's, a period characterized by a big increase in income and wages inequalities. Whereas many studies focus on one particular level of the educational system (Hoxby [2009] on spendings per selectivity of colleges, Jackson et al. [2015] on spendings in K-12 education, etc.), I will try to compare these inequalities at different levels of education (elementary and secondary, higher education) and to combine them. It's also interesting to distinguish a cross-sectional approach while viewing inequalities in a given grade and a longitudinal approach taking into account all the educational career. If the districts or universities with the most spendings are always the same, the longitudinal inequalities are reinforcing; if there is mean reversion in spendings, longitudinal inequalities are attenuated. A previous master thesis (Zuber [2003]), evaluated these inequalities in the French context of public investment in education at the end of the 19th and 20th centuries, the idea is to extend the analysis to the American context in the last decades (1970-2017). Whereas Zuber focused only on public investment in education, I decided to focus on public investment for elementary and secondary education and on both public and private higher education institutions.

For elementary education, I observe that if, over the period, per pupil spendings have more than doubled in real term, the level of inequalities have stayed almost the same with the top 1% having 3% of the spendings, the top 10, 20%, the bottom 50, 40% and the bottom 10, 7% approximately.

Spendings on higher education are far more unequally distributed than elementary and secondary education and inequalities in higher educational spendings have increased over time. Indeed, 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 spendings, the top 10% has 36% (compared to 28% in 1980), the bottom 50% has 20% of the spendings (compared to 26% in 1980) and the bottom 10% has 2% of the overall spendings (compared to 3% in 1980). Mean student spendings have increased by 85% in real terms but this figure conceals huge disparities: spendings for the top 1% have increased by 175% and spendings for the median student have only increased by 50%. These figures concern only one year of education; 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 enrolled longer.

In the coming chapters, chapter 1 contains a short literature review of inequalities in educational spendings in the U.S; chapter 2 presents the data and sources used in this thesis; chapter 3 focuses on K-12 Education; chapter 4 on Higher Education; chapter 5 presents scenarios of combinations of inequalities for the entire educational career, chapter 6 shows some elements of comparison with France and with income inequalities and chapter 7 explores different mechanisms of explanations of these evolutions.

CHAPTER 1

LITERATURE REVIEW: INEQUALITIES IN EDUCATIONAL INVESTMENT IN THE US

1.1 Short History of Education in the US

1.1.1 Elementary education

The first public school in the US date back 1635, with the opening of the Boston Latin School which still operates today as a prestigious public High School. From the beginning, schools were considered as key agents of socialization, but the rationale behind education was rather conservative (teaching being based on family, church, community, and apprenticeship).

In 1642 the Massachusetts Bay Colony made "proper" education compulsory – other New England colonies followed this example. In the 18th century, each town had to publicly supply a "common school" where all students were under the control of one teacher. These schools weren't free, students' families were charged "rate bills".

After the Civil war, the first public school systems to be supported by general taxes was established by a Republican government. In 1848, Horace Mann introduced the first grade system. According to him, universal public education was the best way to discipline citizens. hH won the approval to build a lot of new public schools. By 1870, all states had tax-subsidized elementary schools. A main rationale for public investment in education is that education provides public goods of various types, including endowing citizens with a set of common values. The state also has interests in correcting market failures concerning schooling (like poor households being credit constrained and under-investing in their children - Goldin [2014]).

The public school system was known as the "eight grade school" as most people would stop at the end of elementary school, especially in rural areas. The first Census of 1840 indicated that of the 3.68 million children between the ages of five and fifteen, about 55% attended primary schools and academies. By 1900, 34 states had compulsory schooling laws and by 1910, 72 percent of American children attended school (Graham [1974]). In 1925 the U.S. Supreme Court ruled in *Pierce v. Society of Sisters* that students could attend private schools to comply with state compulsory education laws, thus giving parochial schools an official blessing (Hennesey [1983]).

The Great Depression produced a dramatic collapse of state and local funding for schools. The New Deal reformed education in a way specially designed for the poor and with an anti-elistist approach

to education. The CWA ¹ and FERA ² hired lot of unemployed people to work on public buildings, including public schools. Although the New Deal did not to give money to impoverished school districts, it did give money to impoverished high school and college students.

Democrats consistently underfunded public schools for Blacks in former Confederate states until 1954 when school segregation was declared unconstitutional by the Supreme Court. The US Supreme Court ruling in *Brown v. Board of Education* held that separate but equal was unconstitutional because separate could not be equal. The decade of the 1970's witnessed a substantial reduction in segregation brought largely through legal pressure on local school districts (Hanushek [2002]).

In 1964, Johnson and the Great Society programs expanded federal support for education. For instance, the Elementary and Secondary Education Act of 1965 began giving federal money to local school districts directly. Although state and federal governments originally played a relatively minor role in the financing of US public schools, some support has always come from the state level to help fulfill minimum education mandates. The share of state funding increased over the century and was around 40% in 1970 (Card and Payne [2002]) and 47% in 2015.

In the late 1960s, the case of *Serrano v. Priest* was entered into California state courts and changed the stability of financing. This case alleged that the state funding of schools violated the 14th amendment of the US constitution which requires equal treatment of individuals under the law. The *Serrano* suit argued that because local property tax bases differ, this funding arrangement discriminated against students in poor districts by making the fundings dependent upon the wealth of the community. The Supreme Court ruled in 1973 that the state funding formula didn't violated the individual state constitutions but the *Serrano* case lead to many schools finance reforms. In response to large within-state differences in per pupil spending across wealthy and poor districts, state supreme courts overturned school finance systems in 28 states between 1971 and 2010 (Fulton and Long [1993]). Murray et al. [1998] found that court-ordered finance reform reduced within-state inequality in spendings by 19 to 34 percent. Nevertheless, as between state spendings inequalities are larger than within state spendings inequalities, the ability to equalize the resources available to students at the country level is limited.

1.1.2 The High School "movement"

The period 1890s to the 1930s, sometimes referred to as the Progressive Movement, brought about an enormous increase in the number of high school across the country.

In 1880, American high schools were dedicated to students who wanted to pursue their studies and attend college. By 1910 they had been transformed into core elements of the common school system and had broader goals of preparing many students for work after high school. Many graduates found jobs especially in the rapidly growing white-collar sector. During the first half of the XXth century, the US appeared as an exception in term of secondary schooling. The proportion of pupils continuing their studies beyond primary school was way higher compared to European countries. The rate of obtention of High School diplomas grew a lot between 1930 and 1960 (Figure 1.1). According to Goldin and Katz [1997], this movement was made possible due to local control, local public funding, separation of the Church and of the State, openness and gender neutrality. At the time, the fact that school funding relied on school district (as opposed to the centralized European education system) was seen as a virtue

¹Civil Works Administration

²Federal Emergency Relief Administration

as it allowed local control of the school system and flexibility in term of rules and curricula. "*Areas with greater homogeneity of economic condition, higher levels of wealth, and more community stability were the earliest to extend education to the secondary level and experienced the greatest expansion during the initial years of the high school movement.*" (Goldin and Katz [1997]).

1.1.3 Higher Education

During colonial time, many children of aristocratic and affluent families (particularly descendants of planters) would go to England to receive higher education.

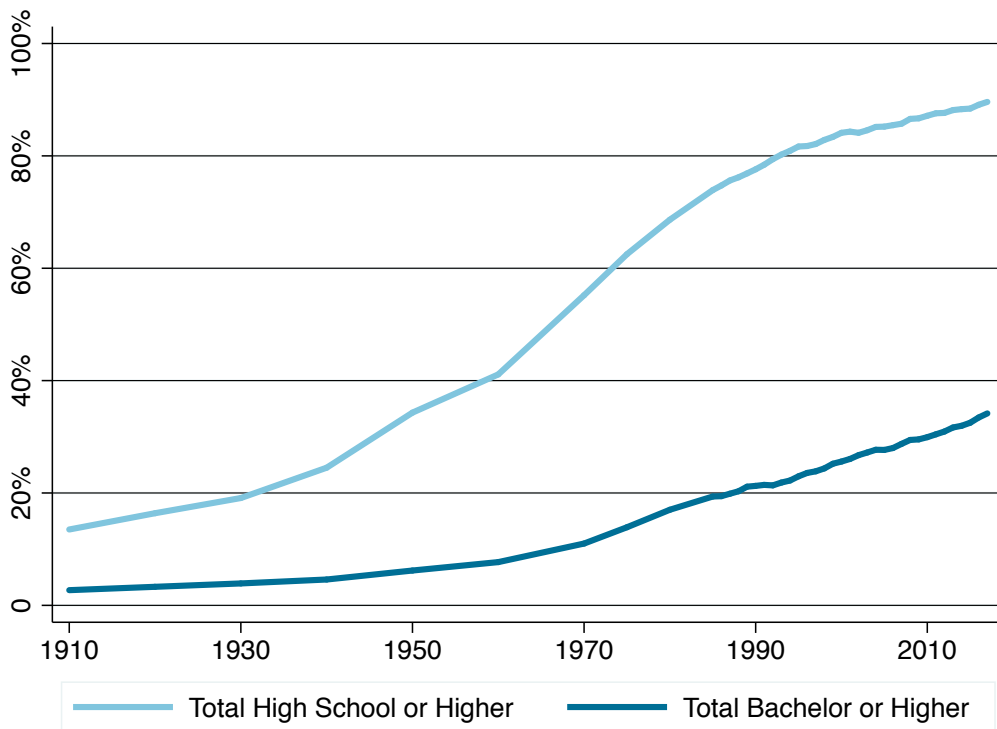
In 1636, the colonial legislature funded Harvard College. Since the very beginning, colleges were viewed as a way to promote upward social mobility. Several religious denomination found their own college, in 1701, Yale College was founded to train orthodox ministers, as Puritans wanted to balance the liberal theology taught at Harvard; the Anglicans set up Kings College (now Columbia University) in New York and Presbyterians created Princeton. In 1900, the number of students going to college was approximately 160,000, in less than 1,000 institutions. The number of colleges grew very rapidly at the beginning of the XXth century. Federal funding from the Morrill Land-Grant Colleges Acts of 1862 and 1890 helped to fund new colleges, many of them being public state universities.

After WWII, the GI Bill made college possible for veterans paying for tuitions and living expenses. Far from being anecdotal, the GI Bill developed a widespread belief of the necessity to go to college (Dhatt [2002]). U.S. higher education was open and forgiving, just as was the case for the lower grades (Goldin [2014]). Students who did not do well enough in high school could go to a community college and then transfer to a four year college. The institutions of higher education were spread out over the country, enabling rural families to send their children to university.

1.2 Global Educational Spendings

Educational expenditures in real term have increased tremendously during the second half of the XXth century. As a percent of GDP, global educational expenditures have gone from 3% of GDP in the 1950's to 7% of GDP today, around 4% being dedicated to K-12 education and around 3% to higher education (Figure 1.2).

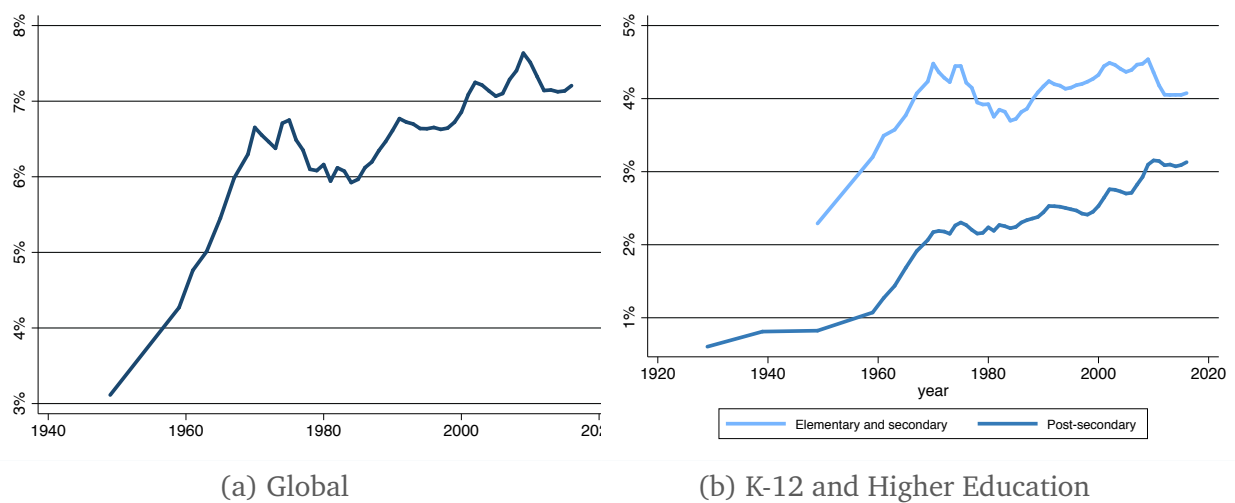
FIGURE 1.1: Percent of High School Graduates and Bachelor Graduates per Cohorts from 1910 to 2017



Reading: In 2017, 35% of individuals have a bachelor degree or higher.

Sources: National Center for Education Statistics based on U.S. Department of Education, National Center for Education Statistics, Annual Report of the Commissioner of Education, 1870 through 1910; Biennial Survey of Education in the United States, 1919-20 through 1949-50; Statistics of Public Elementary and Secondary School Systems, 1958-59 through 1980-81; Statistics of Nonpublic Elementary and Secondary Schools, 1959 through 1980; Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 1981-82 through 2009-10; "State Dropout and Completion Data File," 2005-06 through 2012-13; Public School Graduates and Dropouts from the Common Core of Data, 2007-08 and 2008-09; Private School Universe Survey (PSS), 1989 through 2015; and National High School Graduates Projection Model, 1972-73 through 2027-28. U.S. Department of Commerce, Census Bureau, Current Population Reports, Series P-25, Nos. 1000, 1022, 1045, 1057, 1059, 1092, and 1095; 2000 through 2009 Population Estimates

FIGURE 1.2: Educational Expenditure as a percent of GDP



Sources: National Center for Education Statistics based on Biennial Survey of Education in the United States, Statistics of State School Systems, Revenues and Expenditures for Public Elementary and Secondary Education, Common Core of Data (CCD), "National Public Education Financial Survey," Higher Education General Information Survey (HEGIS), Integrated Postsecondary Education Data System (IPEDS)

1.3 Current Features of the Educational System

1.3.1 K-12 Education

Today, education is compulsory over an age range depending on the state, starting between five and eight years old and ending between ages sixteen and eighteen years old. Currently, the federal government provides just under 10% of total national funding while state and local governments split the remaining costs about equally (Chingos [2017]).

For elementary and secondary education, I only focus on public schools as they are the only one recorded in annual survey of school system finances and as I want to focus on public spendings invested in children. In this section, I provide some aggregate data regarding private schooling to have an idea of where they are in the distribution of educational spendings.

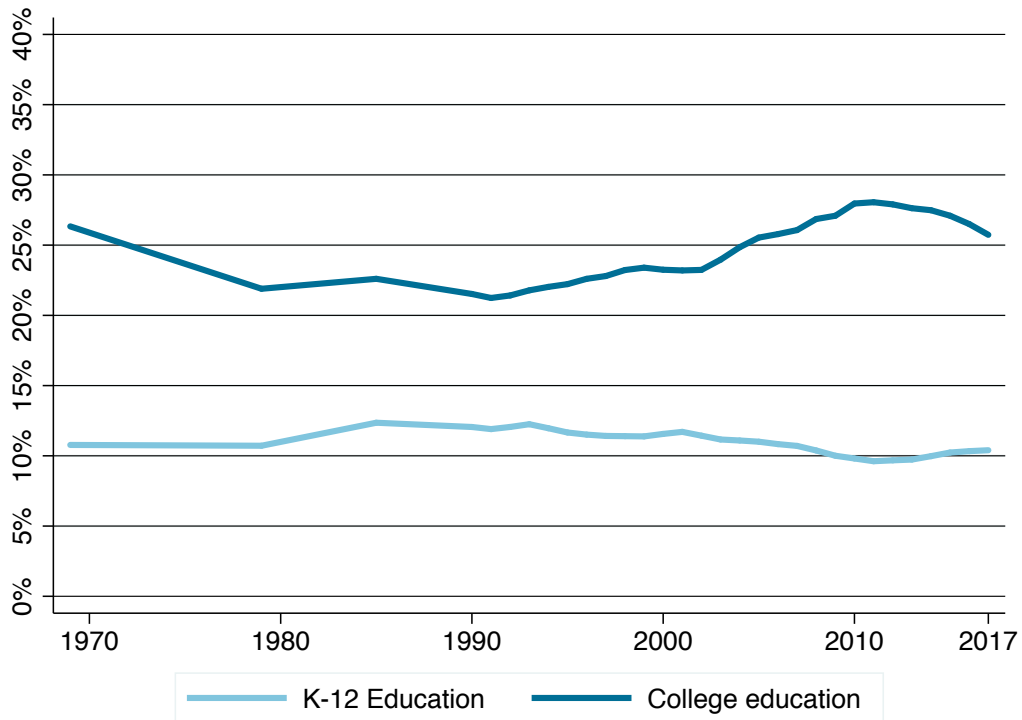
Across the entire period, approximately 10% of pupils are enrolled in private schools (Figure 1.3). There are some disparities depending on the region with 14% of pupils in the private sector in the Northeast, 12% in the Midwest, 9% in the South and 8% in the West.

Furthermore, average per pupil spendings for pupils enrolled in private schools are lower than average per pupil spendings for pupils enrolled in public schools (Figure 1.4). In real term, average per pupil spendings have increase by 113% in the private sector and 62% in the public sector from 1970 to 2016.

1.3.2 Higher education

For higher education, I focus both on public and private institutions because the share of individuals studying in private institutions is significantly higher than during K-12 education; both public and

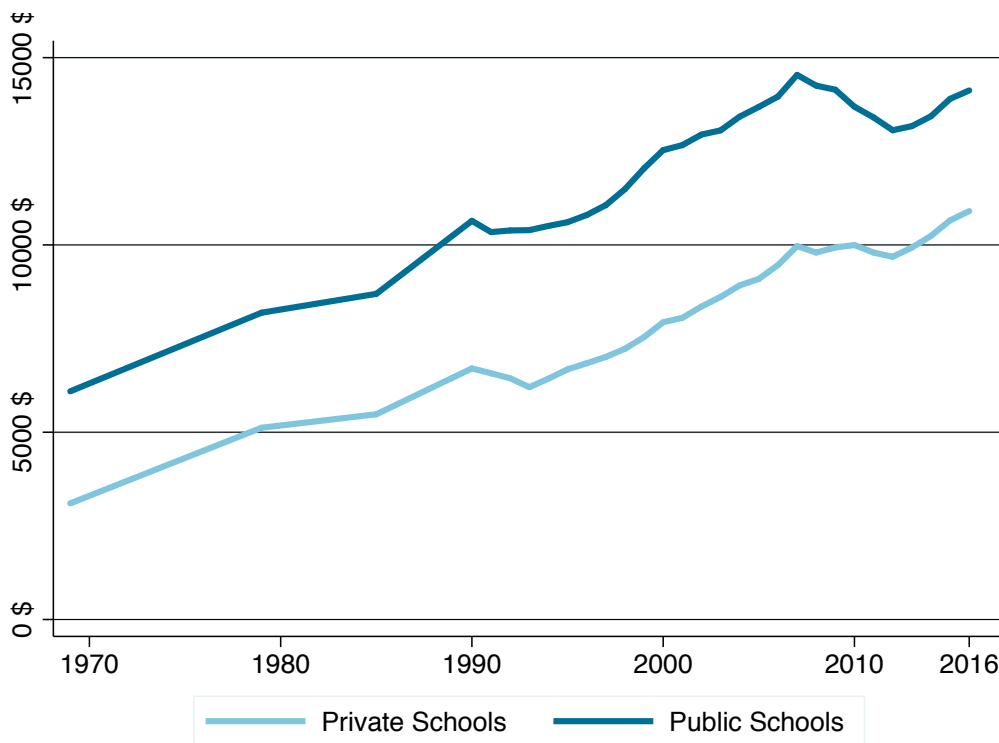
FIGURE 1.3: Percentage of pupils and student enrolled in private schools and private colleges (1970-2017)



Reading: In 2017, approximately 10% of pupils are enrolled in private schools and 25% of students are enrolled in private colleges.

Sources: National Center for Education Statistics based on U.S. Department of Education, National Center for Education Statistics, Annual Report of the Commissioner of Education, 1870 to 1910; Biennial Survey of Education in the United States, 1919-20 through 1949-50; Statistics of Public Elementary and Secondary School Systems, 1959 through 1979; Statistics of Nonpublic Elementary and Secondary Schools, 1959 through 1980; 1985-86 Private School Survey; Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary and Secondary Education," 1985-86 through 2015-16; Private School Universe Survey (PSS), 1991-92 through 2015-16; National Elementary and Secondary Enrollment Projection Model, 1972 through 2027; Opening (Fall) Enrollment in Higher Education, 1959; Higher Education General Information Survey (HEGIS), "Fall Enrollment in Institutions of Higher Education" surveys, 1969, 1979, and 1985; Integrated Postsecondary Education Data System (IPEDS), "Fall Enrollment Survey" (IPEDS-EF:90-99); IPEDS Spring 2001 through Spring 2017, Fall Enrollment component; and Enrollment in Degree-Granting Institutions Projection Model, 2000 through 2027.

FIGURE 1.4: Average per pupil spendings (in 2017 dollars) per year in public and private elementary and secondary Schools (1969-2016)



Reading: In 2016, average per pupil spendings are approximately \$14,000 in the public sector and \$11,000 in the private sector.

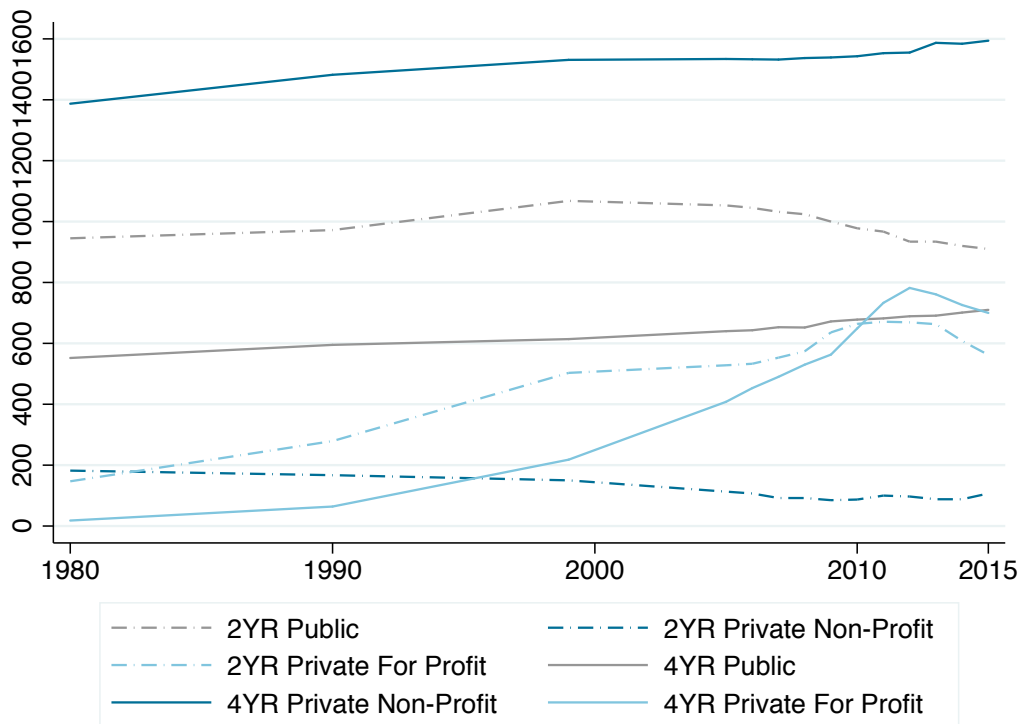
Sources: National Center for Education Statistics based on U.S. Department of Education, National Center for Education Statistics, Annual Report of the Commissioner of Education, 1899-1900 and 1909-10; Biennial Survey of Education in the United States, 1919-20 through 1949-50; Statistics of State School Systems, 1959-60 and 1969-70; Revenues and Expenditures for Public Elementary and Secondary Education, 1970-71 through 1986-87; Common Core of Data (CCD), "National Public Education Financial Survey," 1987-88 through 2014-15; Higher Education General Information Survey (HEGIS), Financial Statistics of Institutions of Higher Education, 1965-66 through 1985-86; Integrated Postsecondary Education Data System (IPEDS), "Finance Survey," (IPEDS-F:FY87-99); IPEDS Spring 2001 through Spring 2017, Finance component; and unpublished tabulations

private institutions receive public fundings –at least through federal grants received by students–, have tuitions and fees, and have grant systems which can be considered as a way to pay for education by the community, even if it doesn't go through taxes.

During the years which my data is collected from, the share of students enrolled in private institutions varies from 20 to 30% (Figure 1.3).

In terms of institutions, we can observe a big increase in the number of for-profit institutions –both among 2-year and 4-year colleges– whereas the number of public and private non-profit institutions is relatively constant. The majority of colleges are private non-profit 4-year institutions. Among public colleges, there are more 2-year institutions than 4-year ones (Figure 1.5).

FIGURE 1.5: Number of public, private non-profit and private for-profit 2-year and 4-year colleges (1980-2015)

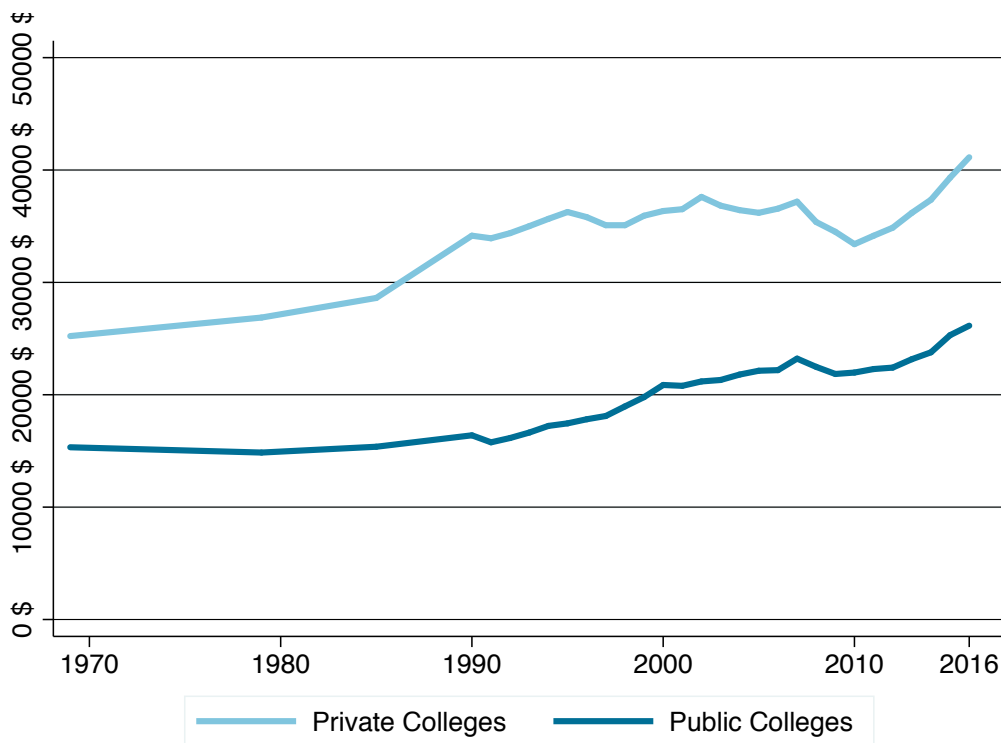


Reading: In 2015, there are approximately 1,600 Private Non-Profit colleges.

Sources: National Center for Education Statistics based on U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey," 1989-90 through 2015-16; Private Schools in American Education; Statistics of Public Elementary and Secondary Day Schools, 1980-81; Schools and Staffing Survey (SASS), "Private School Data File," 1990-91; Private School Universe Survey (PSS), 1995-96 through 2015-16; Higher Education General Information Survey (HEGIS), "Institutional Characteristics of Colleges and Universities" survey, 1980-81; Integrated Postsecondary Education Data System (IPEDS), "Institutional Characteristics Survey" (IPEDS-IC:90-99); and IPEDS Fall 2001 through Fall 2015, Institutional Characteristics component.

Unlike K-12 education, on average, per student spendings are higher in private institutions than in public ones (Figure 1.6).

FIGURE 1.6: Average per student spendings (in 2017 dollars) in public and private colleges (1969-2016)



Reading: In 2016, average per student spendings are approximately \$25,000 in the public sector and \$40,000 in the private sector.

Sources: National Center for Education Statistics based on U.S. Department of Education, National Center for Education Statistics, Annual Report of the Commissioner of Education, 1899-1900 and 1909-10; Biennial Survey of Education in the United States, 1919-20 through 1949-50; Statistics of State School Systems, 1959-60 and 1969-70; Revenues and Expenditures for Public Elementary and Secondary Education, 1970-71 through 1986-87; Common Core of Data (CCD), "National Public Education Financial Survey," 1987-88 through 2014-15; Higher Education General Information Survey (HEGIS), Financial Statistics of Institutions of Higher Education, 1965-66 through 1985-86; Integrated Postsecondary Education Data System (IPEDS), "Finance Survey," (IPEDS-F:FY87-99); IPEDS Spring 2001 through Spring 2017, Finance component; and unpublished tabulations

1.4 Are per Pupil Spendings Important?

In 1966, an especially controversial report was released by a sociology professor at the University of Chicago, titled *the Coleman report* (Coleman [1966]). It was one of the first reports based on detailed statistical data and argued that school fundings have little incidence on student achievement. It is actually mostly arguing that socioeconomic origins and family background matter more in term of achievement than per pupil spendings. Between 1960 and 2000, real per pupil spendings more than doubled and student/teacher ratio fell by 1/3 without a similar increase in student performance (Hanushek [1986]). This is the main rationale toward arguing that "schools doesn't matter" or that "increasing spendings is inefficient to increase educational performance".

First, it should be remembered that the period studied is a decently long period and that the education production function is likely to have changed over the period, especially as more opportunities for women were available on the job market: teacher salaries had to adjust to these outside opportunities. Secondly, for feasibility and convenience, student performance are almost always measured in term of test scores and these test scores might not be a good indicator of improvements in educational performances and non cognitive outcomes created by higher spendings. It might be that schools with more funding are able to invest more in extracurricular activities like daycare, after school programs, summer schools which aren't effective at raising test scores but do have an influence on student cognitive development and behavior. Lastly, when it comes to schools, outcomes aren't obvious since the objective can be multi-dimensional (increase educational attainment of pupils, make good citizens, raise their consciousness, attenuate inequalities created by different household environment...) and the measure of these outcomes can be subject to a lot of biases. In this sense, focusing on costs of schooling –even if it's not synonymous to the benefits students get out of it– is interesting as it is an impartial way of measure and is a good element of comparison, over time, over different areas and between several levels of education.

1.5 Inequality in Investment in Education

1.5.1 K-12 Education

In the United States, schools are funded by local property taxes³. Because of this, the more affluent a neighborhood, the higher the funding for that school district. Duncan and Murnane [2011] showed that when the K-12 educational system was implemented, Americans accepted inequalities in funding as incomes of families at the bottom of the distribution were growing quite rapidly, inequalities remained relatively stable and the country was characterized by high rate of inter-generational economic mobility. They also state that "*Between 1977 and 2007, America's GDP per capita nearly doubled again. This time, however, the fruits of economic growth were confined to a smaller proportion of the population*". As C.Goldin (Goldin [2001]) argues, the virtues of the past could have transformed themselves in flaws of the present as is shown with school systems receiving funding based on property taxes, there are wider disparities in funding between wealthy and poor districts. Residential segregation is the driving force of this unequal system.

³The proportion of local taxes among school fundings varies a lot between states, as is seen in the case of New Hampshire and New Mexico: 85% of school resources come from local taxes in New Hampshire and 12.3% in New Mexico (Fischel [2006])

Hoxby [1998], studies the evolution of inequalities in per pupil spendings in Massachusetts, Illinois, and California. Overall, she finds that inequality in per-pupil spending is relatively stable from 1900 to 1990 and that the decades in which spending inequality rose the most (the 1930's and the 1970's) were also decades of rising income inequality and the decade in which spending inequality fell the most (the 1940's) was a decade of falling income inequality.

This master thesis only focuses on inequalities created by unequal investment in schools whereas investment at home also represents a big amount of inequalities in educational investment. Duncan and Murnane [2011] showed that in the 1970's high-income families spent about \$2,700 more per year than low-income families on child enrichment such as books, computers, high-quality childcare, summer camps, private schooling, music lessons, and summer camp. By 2005, this gap had nearly tripled, to \$7,500.

1.5.2 Higher Education

In terms of higher education, some authors (Ellwood et al. [2000], Belley and Lochner [2007]) observe a dramatic increase in the role of family income in explaining college attendance, college quality and amount of hours worked while studying from 1980s to 2000s. According to them, this is explained by the fact that more people are credit constrained today than in the early 1980's. Orfield and Lee [2005] showed that only 11% of children from the bottom fifth of earnings earn a college degree while 80% of the top fifth earn one. Rates of college completion increase by only four percentage points for low-income cohorts born around 1980 relative to cohorts born in the early 1960s but by 18 percentage points for high income families. *“Even among those who had the same measured cognitive skills as teenagers, inequality in college entry and completion across income groups is greater than it was two decades ago”* (Bailey and Dynarski [2011]). There also seems to be a decrease in the fraction of students from low-families at the institution with the highest upper mobility rates which let forecast lower mobility rate for most recent cohorts (Chetty et al. [2017]).

1.5.3 Link between inequalities in educational investment and wages inequalities

This growth in inequalities in higher educational spendings goes in parallel with an increase in income and wages inequalities. Goldin and Katz [2009] estimate that between the early 1980s and 2005, demand for college graduates increased by 3.5% per year while relative supply of college graduates increased by 2% per year only, creating a growth in college rate premium at the rate of 0.9%. But why hasn't the supply of educated workers kept up pace with demand? Some authors (Kane [2007]) suggest that the recent rise in tuition costs, decline in Pell Grant offerings, and gradual erosion of real student loan borrowing limits in the U.S. may be responsible for the modest response in aggregate college attendance rates despite the sharp rise in its economic returns. Carneiro and Heckman [2003] argue that the current tax system favor human capital on the job (with tax deduction) rather than full time schooling (as there is no deduction for college tuitions). Katz (in Heckman et al. [2005]) argues that the change in family structure, with more single-parent families can help explain the slower growth of educational attainment. Card and Krueger [1992] showed that people educated in states with higher quality schools have higher return to additional years of schooling, showing that more investment in someone's education matters for its succeeding wages.

Even if this master thesis can't provide causal evidence, chapter 6 presents some elements of comparison with wages inequalities over space (comparing French and American concentration) and over time in the US.

CHAPTER 2

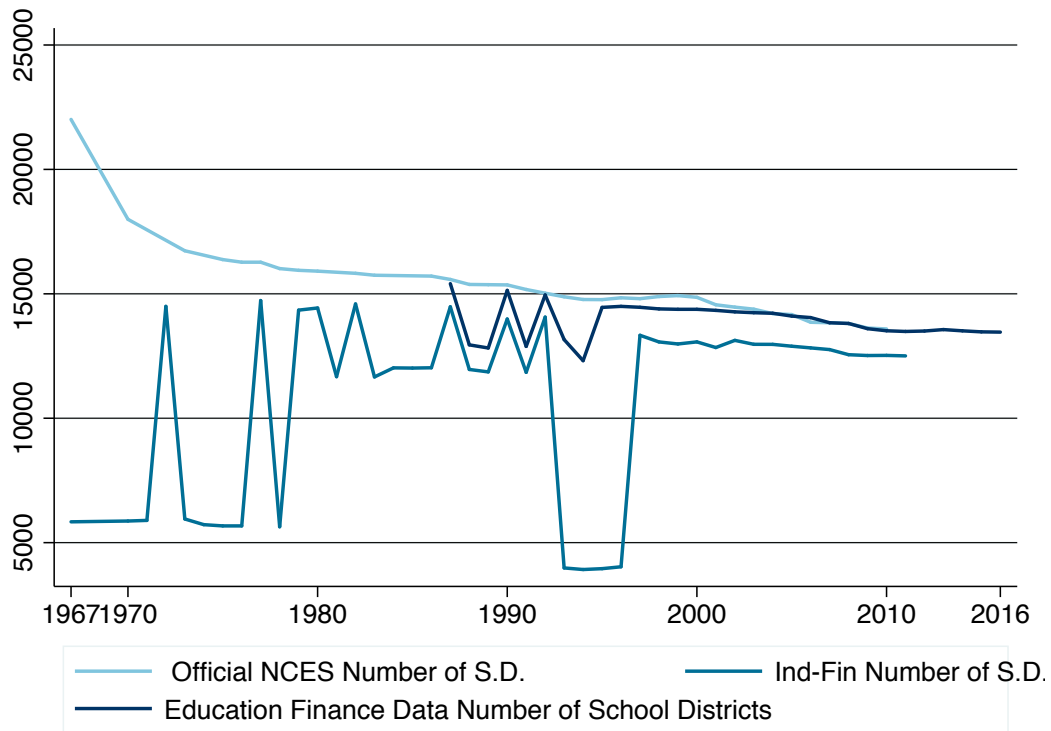
DATA SOURCES AND CONSTRUCTION OF DATABASES

2.1 Elementary and Secondary Data: Annual Survey of School System Finances

The Census of Governments has been conducted every five years since 1967 and records administrative data on school spending for every school district in the US. This is the data source used in all existing national studies of school finance reforms. The INDFIN contains school district finance data annually for a sub-sample of large school districts from 1967 to 1991. It means that from 1970 to 1987, in years ending in '2' and '7' the entire universe is canvassed and in intervening years, a sample of the population of interest is surveyed (Figure 2.1). The survey coverage includes all state and local governments in the United States. After 1987, the CCD School District Finance Survey consists of data submitted annually to the National Center for Education Statistics and includes data on school spending for every school district in the US. Data on per pupil spendings are directly available from 1987 to 2016 (*Public Elementary-Secondary Education Finance Data*, US Census Bureau) but I have to recompute them for previous years (*Data on Historical Finances of Individual Governments* (IndFin), US Census Bureau) so that I obtain an approximation of per pupil spendings. The way I compute it is by keeping only administrative entities having "SCH", "EDUC", "VOCATIONAL", "ATTENDANCE AREA", "REAA", "COLLEGE", "ELEM", "S.A.U." or "RESA" in the name and then dropping the ones for whom "SCH" was in the name of the city or the congressional district for instance. I intend to keep only school districts this way as the original data includes local government entities such as counties, municipalities, townships, special districts, and school districts. I then divide total educational expenditures by the population of the school district to obtain per pupil spendings for 1967 and every year from 1970 to 2012. For the year where I have the two sources of data (1987-2012), I check that enrollment data and per pupil expenditure data are of the same order of magnitude for each district.

In order to conduct longitudinal analysis of per pupil spendings, I merge data over time with the district identifier. Due to changes in school districts boundaries and incomplete data in the 1970's, not all school districts are present for the 12 years studied (1970 to 1982). Out of the 13,983 that existed at some point in time in the years studied, only 3,633 districts have data for all the 12 years.

FIGURE 2.1: Number of School Districts covered by the Data



Sample: 1967 to 2016 School Districts

Sources: Annual Survey of State and Local Government Finances (Ind-Fin) from 1967 to 2012, Public Elementary-Secondary Education Finance Data from 1987 to 2016, NCES Statistics based on U.S. Department of Education, National Center for Education Statistics, Annual Report of the Commissioner of Education, 1870 through 1910; Biennial Survey of Education in the United States, 1919-20 through 1949-50; Statistics of State School Systems, 1951-52 through 1967-68; Statistics of Public Elementary and Secondary School Systems, 1970-71 through 1980-81; Statistics of Public and Nonpublic Elementary and Secondary Day Schools, 1968-69; Statistics of Nonpublic Elementary and Secondary Schools, 1970-71; Private Schools in American Education; Schools and Staffing Survey (SASS), "Private School Questionnaire," 1987-88 and 1990-91; Private School Universe Survey (PSS), 1989-90 through 2009-10; and Common Core of Data (CCD), "Local Education Agency Universe Survey" and "Public Elementary/Secondary School Universe Survey," 1982-83 through 2010-11

I drop districts for which more than 4 years of data are missing and I am left with 6,414 districts. To have a comparable sample, I infer missing values (for districts with less than 4 years out of the 12) computing the average between adjacent years for which I have the data. Regarding enrollment, I compute the average over the 12 years or over the number of years with available data when some years are missing. I do the same for the generation born in 1992 (in K-12 education from 1998-2009) and for the most recent year of available data (2005 - 2016) even if less districts have missing values for these more recent years. I present robustness check with a constant coverage of districts and without inferred values (3,633 districts in the 1970's and 15,981 districts in the 1990's-2000's) in Appendix B. Not having data on movers, my analysis assumes that districts and their residents are fixed. I also assume that there are no repeaters. The effect of repeaters is ambiguous: primary and secondary repeaters are more likely to have a shorter educational career, reducing inequalities in spendings while repeaters in higher education are people having nonlinear curricula, more likely to increase inequalities in spendings.

2.2 College Data: IPEDS data

IPEDS ¹ is a collection of surveys spanning from 1980 to 2017 regarding college finance, enrollment, admissions, completions, graduation, outcome, institutional characteristics, libraries, etc. I compute per student spendings for instructional expenditure, per student total spendings without grants and with grants, average total expenditures (excluding half of research spendings, hospital expenditure and independent operations), etc. from 1980 to 2017 based on total expenditure and fall total enrollment. From 1980 to 2017, there are 7,121 colleges in the database, distributed as followed in 2017 ²:

TABLE 2.1: Sector of Colleges in 2017

Sector of institution	Frequence	Percentage
Administrative Unit	75	1.05%
Public, 4-year or above	775	10.88%
Private not-for-profit, 4-year or above	1,701	23.89%
Private for-profit, 4-year or above	661	9.28%
Public, 2-year	981	13.78%
Private not-for-profit, 2-year	169	2.37%
Private for-profit, 2-year	864	12.13%
Public, less-than 2-year	248	3.48%
Private not-for-profit, less-than 2-year	85	1.19%
Private for-profit, less-than 2-year	1,562	21.94%
Total	7,121	100.00

Reading: In 2017, 10.88% of colleges are public, 4-year or above colleges.

Sample: 2017's colleges and universities

Sources: IPEDS 2017

¹Integrated PostSecondary Education Data System

²As for K-12 education, I present in Appendix B results using a constant coverage of institutions with institutions that are in the database from 1980 to 2017 (3,453 institutions out of the 7,121 that existed at some point between 1980 and 2017).

2.2.1 Educational Spendings

Unlike for elementary and secondary education, higher education institutions have other purposes than instruction: most are also research institutions for most of them. As such, the separation of educational expenditure and research expenditure is a matter of convention. For instance, IPEDS includes "departmental research funding" in "instructional expenditure" whereas other research funding belongs to "research expenditure". To minimize the bias coming from convention, I construct several variables of educational spendings. My main specification is Instructional Expenditures as this is a type of expenditure that focuses the most on educational purpose and that is comparable over the entire period (many categories of expenditure have known evolution in IPEDS survey). My second main specification is Average Total Expenditure (excluding half research expenditure, hospital expenditure and independent operations) which also includes part of research spendings and spendings for infrastructure (as well as spendings for student service, academic support, institutional support, etc.). I present this as an element of comparison as students benefit, at least partly from having higher research spendings: they have better faculty members, better facilities... Keeping only half of research spendings is a convention but in the absence of evidence about how much of research spendings actually benefit to students, this can be considered as a reasonable assumption. Average Total Expenditure is also one of the category that is most stable over time.

It is important to take into account other definitions of expenditure as some authors (Webber and Ehrenberg [2010]) showed that instructional spending per full-time equivalent (FTE) student in both public and private 4-year colleges and university grew at a slower rate than median expenditures per FTE student in other categories of expenditures (research, public service, academic support, student services, scholarships and fellowships) and that these other categories of expenditure are more important towards influencing graduation in less selective colleges. As for every empiric work, but maybe even more for descriptive work, it is important to present several hypotheses so that results do not rely on a particular specification. That is why I present results with 6 different definitions of spendings in the Appendix A³:

- **Instruction per student:** based on IPEDS instruction spendings divided by total enrollment
- **Average total expenditure per student :** total expenditure (excluding hospital expenditures, independent operation and half of research expenses) divided by total enrollment
- **Spendings per student:** spendings for instruction, student service, public service, academic support and institutional support, divided by total enrollment
- **Spendings per student with grants:** same variables as "Spendings per student" with grants and scholarships expenditures divided by total enrollment
- **Average tuition:** total tuition revenue divided by total enrollment
- **Average total public expenditure per student:** share of public (federal, state or local) among total expenditure divided by total enrollment. As for average total expenditure, this category also includes research expenditures. Ideally, this would be my second main specification, to see if the distribution of public spendings has evolved in a particular way. Unfortunately, the categories of

³See Appendix A for more detail on the definition of spendings

"public spendings" in IPEDS have changed a lot over time (specially when it goes to federal and state grants). That's why I prefer to focus on Average Total Spendings as a second specification, it being more reliable over time.

2.2.2 Length of studies

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

$$Associate_Length = Dropout*1+Graduation_2_Year*2+Graduation_3_Year*3+Graduation_4_Year*4$$

$$Bachelor_Length = Dropout*2+Graduation_4_Year*4+Graduation_6_Year*6+Graduation_8_Year*8$$

With *Associate_Length* the average length of studies for an associate degree, *Bachelor_Length* for a bachelor degree, *Dropout* the proportion of dropout (as detailed information on dropout isn't available, I assumed that dropouts of associate degree have 1 year of studies and dropouts of bachelor degree have 2 years) and *Graduation_n_Year* the proportion of students that take *n* years to graduate. 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 to graduate but as many students dropout, the average length of studies is smaller than the length required to complete the degree. Indeed, in 2017 for bachelor studies, on average 24% of students graduate within 4 years (they were 32% if 2005), 45% within 6 years (as in 2005) and 49% within 8 years (as in 2005); for associate degree, 37% graduate within 2 years, 57% within 3 years and 59% within 4 years.

For the length of master, as I don't 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 expenditures and to the same sector (Public, Private, 2 years and 4 years institutions, etc.). For institutions that only report enrollment for undergraduate student 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 don't have data on length of studies per institution prior to 2005, I used 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] and Denning and al. (2019)).

CHAPTER 3

K-12 EDUCATION

In this section, I study the distribution of elementary and secondary spendings, from 1967 to 2016. Not having data at the school but at the district level, I only study between districts inequalities, which is a lower bound for inequalities in educational spendings as not all schools have the exact same per pupil spendings within a district¹.

3.1 Cross-sectional analysis

Overall, the distribution of spendings for one year of elementary or secondary education is pretty stable. Around 3% of the overall spendings are dedicated to the top 1% of pupils for whom the most is spent, between 14% and 19% for the top 10% of pupils and around 40% for the bottom 50% of pupils. We observe a small decline in the concentration of educational investments from 1967 to 1995, date when this concentration starts to increase again so that over the entire period, the level of inequalities in these spendings doesn't change much.

¹Studying Texas school districts, Lane et al. [2018] showed that large gaps in teacher experience and facility quality remain even among students in the same school district and that state-level equalization schemes may not be sufficient to narrow socioeconomic gaps if large within-district disparities continue to exist.

TABLE 3.1: Evolution of Cost and Distribution of per pupil Expenditure from 1967 to 2016 in constant 2017 dollars (cross-sectional analysis)

	1967	1970	1975	1980	1985	1990
Total number of students in the data	28,604,772	28,548,784	30,438,324	35,653,084	32,669,830	40,432,080
Total number of districts in the data	5,837	5,869	5,673	14,430	12,016	15,138
Mean of per student spending	\$4,841	\$5,708	\$6,198	\$6,782	\$7,483	\$8,492
Top 0.1% of students	\$19,187	\$21,766	\$19,043	\$18,788	\$20,715	\$25,652
Percentage of the overall spending	0.95%	1.07%	0.70%	0.46%	0.41%	0.40%
Top 0.5% of students	\$12,144	\$15,975	\$15,531	\$14,622	\$16,800	\$20,135
Percentage of the overall spending	2.16%	2.31%	1.75%	1.38%	1.37%	1.42%
Top 1% of students	\$10,327	\$13,842	\$12,989	\$13,103	\$15,187	\$18,081
Percentage of the overall spending	3.28%	3.65%	2.90%	2.43%	2.45%	2.53%
Top 10% of students	\$6,584	\$7,954	\$8,418	\$8,913	\$9,971	\$12,165
Percentage of the overall spending	16.5%	18.5%	17.0%	15.8%	16.1%	16.6%
Bottom 50% of students	\$4,540	\$5,367	\$5,864	\$6,556	\$7,187	\$7,926
Percentage of the overall spending	38.7%	37.0%	39.5%	40.0%	39.7%	39.0%
Bottom 10% of students	\$3,242	\$3,586	\$4,249	\$4,744	\$5,217	\$5,794
Percentage of the overall spending	5.86%	5.44%	6.03%	6.19%	5.78%	6.19%
	1995	2000	2005	2010	2016	Evolution
Total number of students	43,807,624	46,432,784	48,055,256	48,266,208	48,514,348	+ 69%
Total number of institutions in the data	14,454	14,378	14,105	13,515	13,471	+131%
Mean of per student spending	\$8,761	\$9,723	\$10,863	\$11,636	\$11,833	+144%
Top 0.1% of students	\$24,641	\$45,439	\$48,908	\$44,358	\$38,616	+101%
Percentage of the overall spending	0.33%	0.58%	0.65%	0.58%	0.57%	
Top 0.5% of students	\$19,815	\$20,650	\$24,982	\$26,713	\$28,041	+131%
Percentage of the overall spending	1.33%	1.62%	1.67%	1.65%	1.63%	
Top 1% of students	\$17,950	\$18,773	\$21,942	\$24,225	\$25,563	+148%
Percentage of the overall spending	2.40%	2.63%	2.75%	2.72%	2.76%	
Top 10% of students	\$12,307	\$13,043	\$14,968	\$16,426	\$17,196	+161%
Percentage of the overall spending	14.4%	16.2%	17.1%	18%	18.7%	
Bottom 50% of students	\$8,108	\$8,964	\$9,819	\$10,326	\$10,481	+131%
Percentage of the overall spending	40.1%	41.3%	40.4%	39.5%	38.3%	
Bottom 10% of students	\$6,435	\$7,561	\$8,243	\$8,613	\$8,488	+162%
Percentage of the overall spending	6.86%	7.17%	7.01%	6.82%	6.48%	

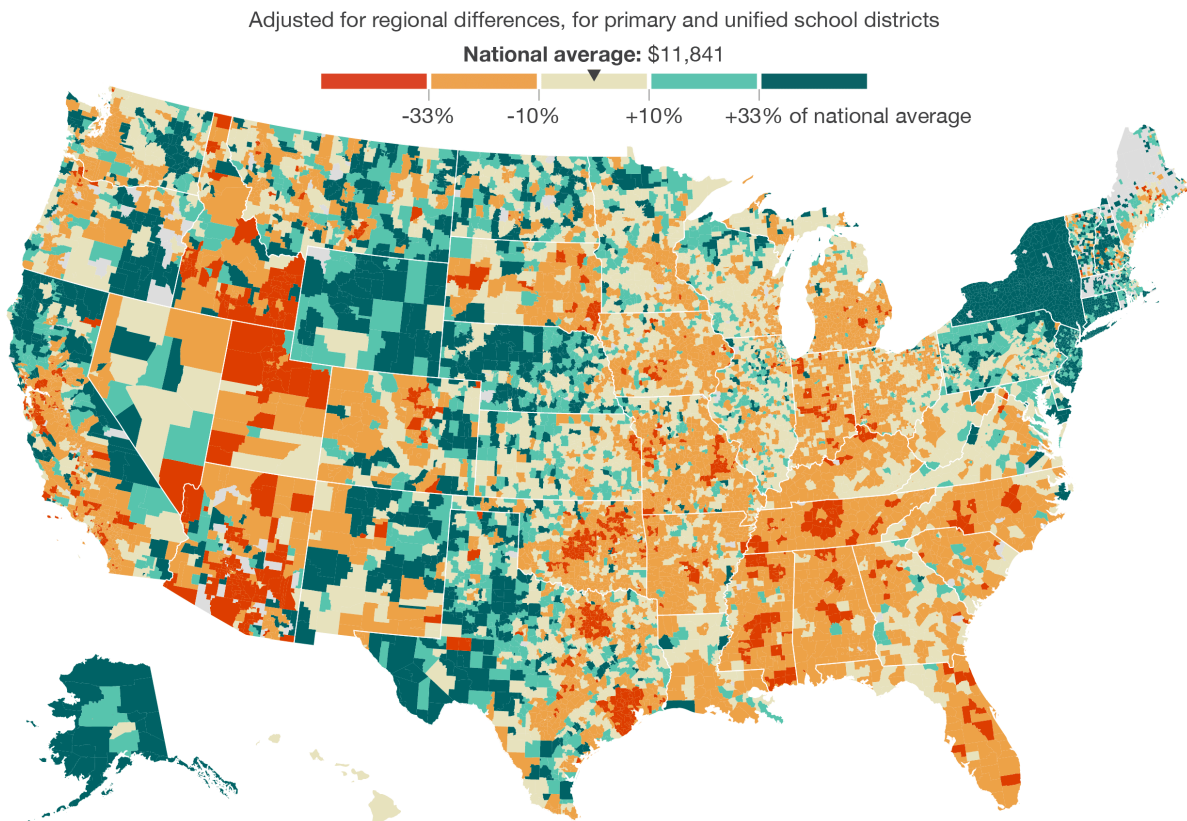
Reading: In 2016, the top 10% of student for whom the most is spent have spendings above \$17,196 per year, they have 18.7% of the overall spendings.

Sample: 1967-2016 School Districts

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1985 and Public Elementary-Secondary Education Finance Data for 1990-2016, US Census Bureau*

The following map shows that even accounting for regional cost differences, there is a big heterogeneity in per pupil spendings across districts.

FIGURE 3.1: Spending per student, by school district in 2013



Sample: 2013 School Districts

Source: NPR (Alyson Hurt and Katie Park) based on Education Week Research Center, U.S. Census Bureau, 2016

3.2 Longitudinal analysis

As the "career" of a pupil doesn't stop after one year, inequality in spendings must be studied all over the educational trajectory. The purpose of this section is to study inequalities in K-12 education, from first grade to the end of high school. I don't take into account pre-school, because school finance data doesn't include it and because it's more diverse and less often publicly funded (apart from some special programs like Head Start or Perry preschool). This is to me remembered that Kindergarden already account for a big part of inequalities in education at the youngest age.

I study K-12 education for 12 consecutives years (from 1970 to 1982; 1975 to 1987 and so on). As I don't have data on which specific grade pupils are enrolled to, I compute the mean spendings for each district. This is very likely that a senior High School year costs more than a First grade year but this is the same approximation made for all districts so that the year cost I overestimate for first graders is underestimated for high school students.

In this first part, I make the assumption that everyone is going to elementary and secondary school and have (at least) 12 years of education. The inequality in spendings isn't coming through the unequal length of studies. In chapter 5, I will release this assumption and study the inequality coming through different lengths of studies.

Over the period, the concentration of educational investment are similar for the cross-sectional and the longitudinal analysis showing that there seems to be persistence in educational spendings: the first-order autocorrelation coefficient of per-pupil spendings is 0.71. Districts that are big spenders tend to stay big spenders, districts that are small spenders tend to stay small spenders so that over 12 years, inequalities are similar to over 1 year.

TABLE 3.2: Distribution of per pupil spendings for 12 years of elementary or secondary education in the 1970's and in the 1990's-2000's

	1970-1981		1998-2009	
	Percentage of the Overall spendings	Amount (in 2017 dollar)	Percentage of the Overall spendings	Amount (in 2017 dollar)
Mean spendings		\$79,678		\$130,265
Top 0.1%	0.93%	\$231,022	0.56%	\$642,335
Top 0.5%	1.90%	\$164,551	1.64%	\$285,318
Top 1%	2.86%	\$168,665	2.68%	\$257,530
Top 10%	15.82%	\$102,330	16.78%	\$178,449
Bottom 50%	40.51%	\$76,708	40.91%	\$118,281
Bottom 10%	6.49%	\$56,591	7.19%	\$100,935

Reading: In the 1970's, the top 10% of students for whom the most is spent have spendings above \$102,330 (in 2017 dollars), they have 15.8% of the overall spendings.

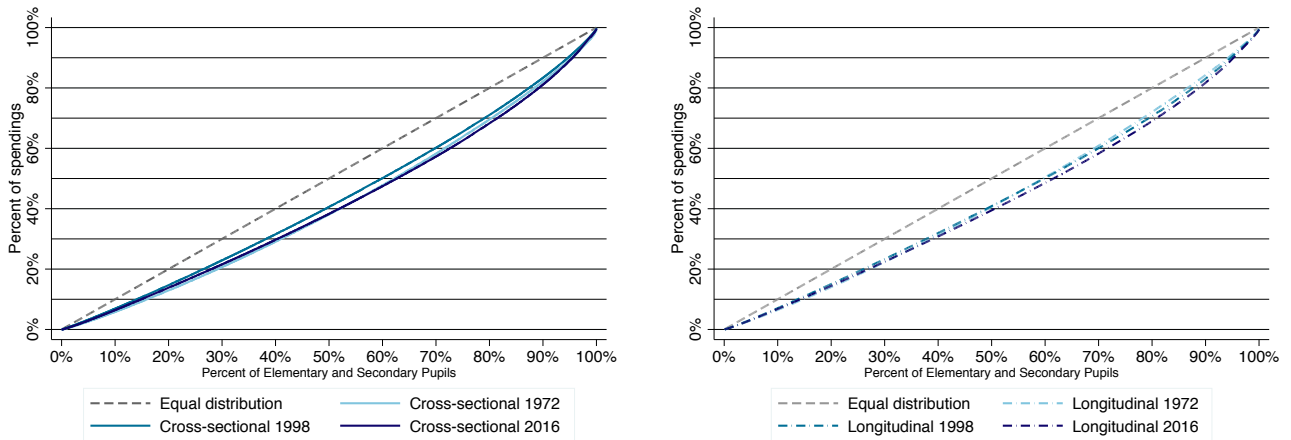
Sample: 1970-1981 School Districts and 1998-2009 School Districts

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1985* and *Public Elementary-Secondary Education Finance Data for 1990-2016*, US Census Bureau

3.3 Comparison over time

Between the 1970's and the 2000's, the distribution of spendings for education has changed very little (Figure 3.2), compare, for instance, to the evolution of wages inequalities. This is striking to observe that over the period, per pupil spendings in real term have more than doubled (Figure 3.3) whereas the level of inequalities have stayed almost the same with the top 1% having 3% of the spendings, the top 10, 20%, the bottom 50, 40% and the bottom 10, 7% approximately. The variance of per pupil spendings seems to have decrease or at least stayed stable until 2000 and then increase (Figure 3.3).

FIGURE 3.2: Distribution of longitudinal and cross-sectional of per pupil spendings in the 1970's and in the 2000's



(a) Cross sectional analysis

(b) Longitudinal analysis

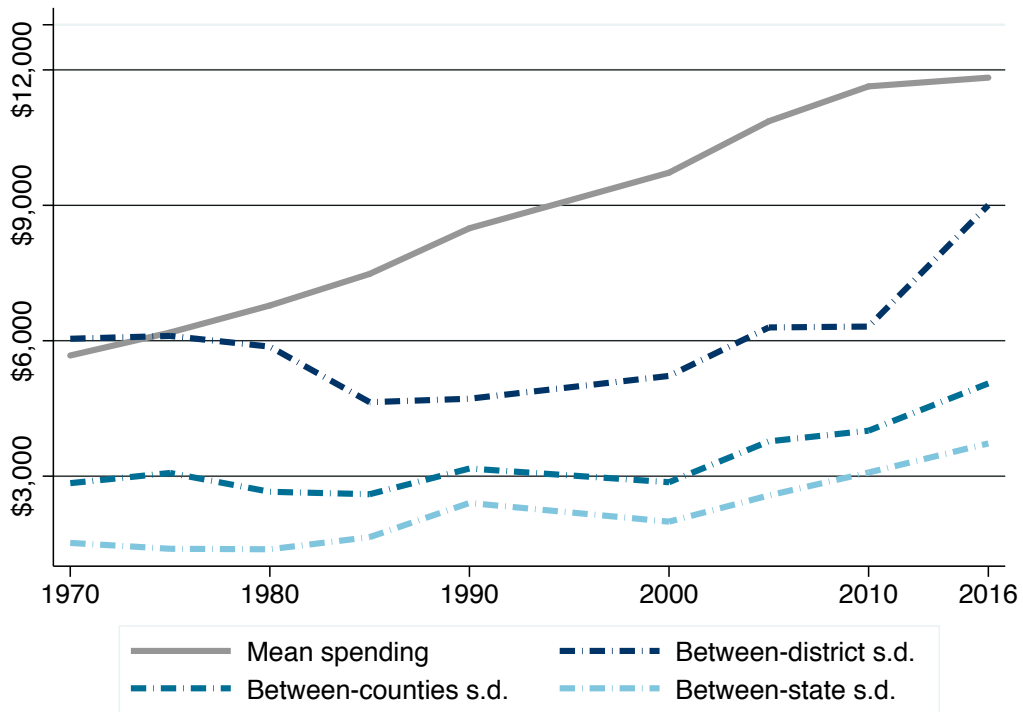
Sample: 1970's and 2000's School Districts

Sources: *Historical Finances of Individual Governments (IndFin) for 1970-1981* and *Public Elementary-Secondary Education Finance Data for 1998-2009, US Census Bureau*

N.B.: For the longitudinal analysis, I made the assumption that everyone is getting a K-12 education

This is striking to observe that, despite school finance reforms to equalize spendings across districts, the concentration of educational investment have stayed fairly stable over the period. Decomposing the total variance in per pupil spendings across districts in a between states and between counties component, we can observe that the variance between state has increased over time from around 25% of the total variance in 1970 to around 40% (Figure 3.4). The between-counties variance has stayed fairly stable between 20% and 25% over the period and the between districts variance have decrease, presumably under the influence of school finance reforms.

FIGURE 3.3: Evolution of average spendings in 2017 dollars and standard deviation between district, between counties and between states

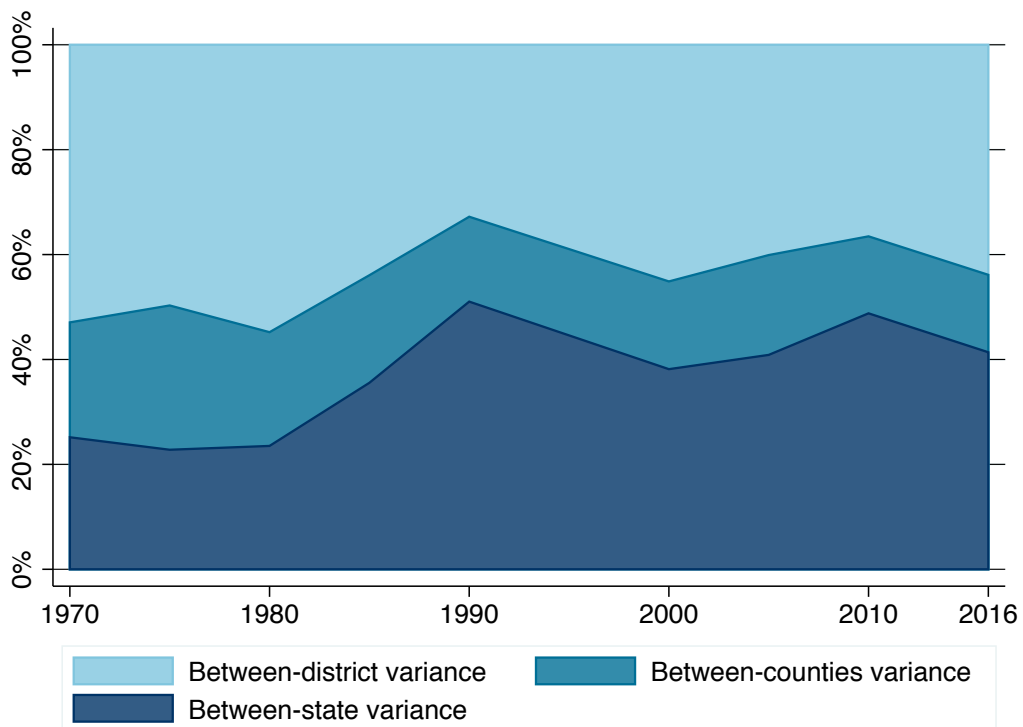


Reading: In 1970, average per pupil expenditure per district where around \$6,000 and between counties standard deviation was around \$3,000.

Sample: 1970 to 2016 School Districts

Sources: *Historical Finances of Individual Governments (IndFin)* for 1967-1987 and *Public Elementary-Secondary Education Finance Data for 1987-2016*, US Census Bureau

FIGURE 3.4: Decomposition of the variance in per pupil between district into a between-state part, a between-county part and a between-district part from 1970 to 2016



Reading: In 1970, around 25% of the total variance was between-state variance and 25% was between counties variance, the rest was between district variance.

Sample: 1970 to 2016 School Districts

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1987 and Public Elementary-Secondary Education Finance Data for 1987-2016, US Census Bureau*

3.3.1 Role of school finance reforms

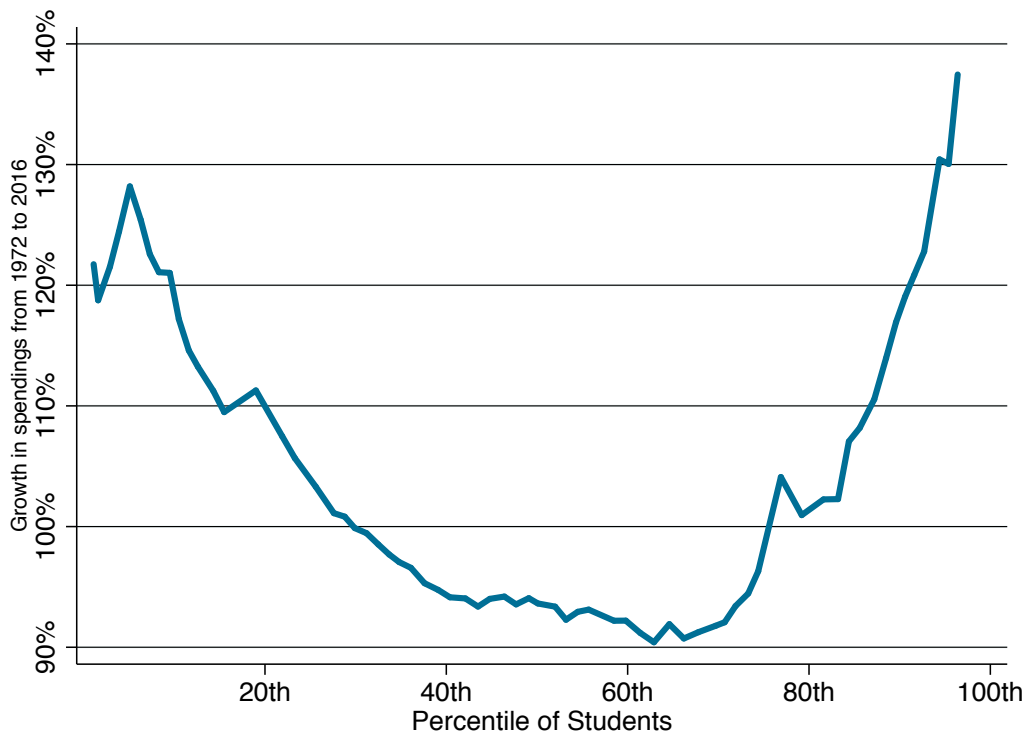
Some event studies (Jackson et al. [2015]) have found a reduction in inequalities in spendings following school finance reforms in the 1970's and early 1980's. Several explanations can reconcile my findings with them: first, they study a constant pool of districts (poor vs rich districts) whereas I have a pool of districts in each decile changing over time: poor districts of yesterday aren't the exact same one as those of today. Secondly, they study reforms in the 1970's and 1980's, whereas I observe a small increase in inequalities starting from 2000. Thirdly, they showed that even if a reform is effective at reducing per pupil spendings, after 5 years of increase in per pupil spendings in the poor districts when induced to do so, there is a reverse to the pre-existing trend of reduction. Lastly, even if school finance reforms are effective in reducing inequalities in per pupil spendings at the state level, it seems to have been counterbalanced by the increase in between-state per pupil variance, such that, at a global level, the level of inequalities in K-12 spendings has changed very little since the 1970's. Their last footnote goes in this direction: *"Today, most of the variance in per pupil spending is across states, rather than within state. Thus, the effect of school finance reforms can be limited, as far as equalisation of spending across the U.S. is concerned"*.

In the same direction, Card and Payne [2002] found that gap in state aid between a poor district and a rich district widened by \$300 per student more in states where the financing system was found unconstitutional than in other states but that the decrease in inequalities in spendings between districts was partially offset by fiscal substitution effects through changes in local revenue collections (districts where state aid increase the least tended to increase more local revenue) and was partially or fully offset by widening inequalities in local revenues between richer and poorer districts. Hoxby [2001] showed that there are many differences between finance reforms schemes that intended to level up or level down the level of spendings: schemes that level down have unintended consequences as even poor districts can end up worse off in some cases. Lastly, Biasi [2019] shows that households respond to the change in the tax price introduced by each reform by "voting with their feet" and moving across districts. This sorting affects house prices and the property tax base, which in turn affect school districts' revenues, mechanism that can mitigate the ability of school finance reforms to decrease inequalities in spendings.

3.3.2 Growth incidence curve

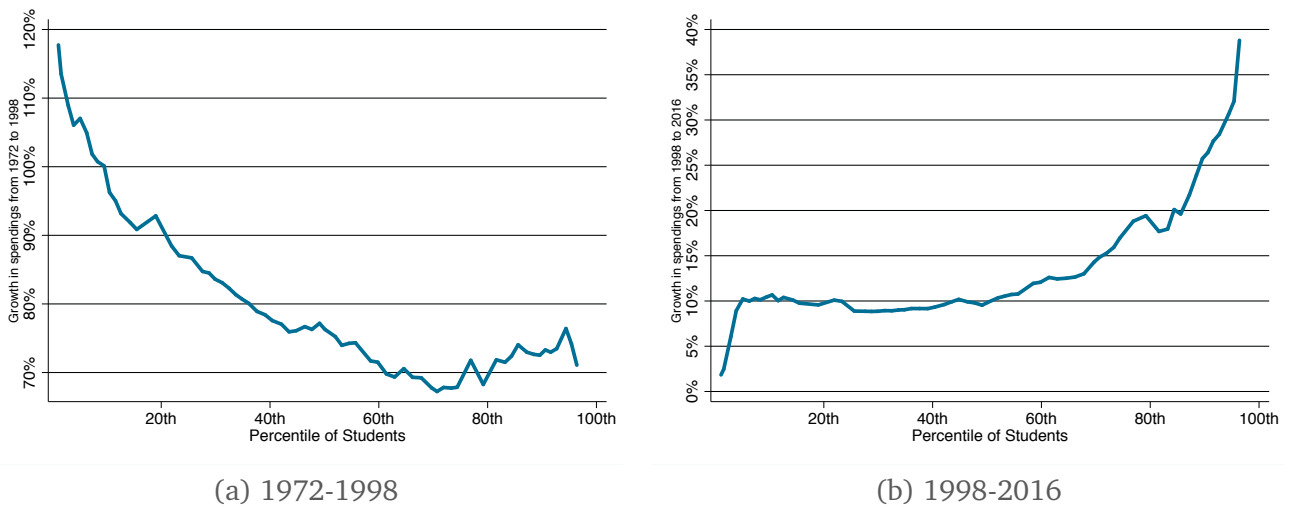
To see how have evolved spendings all along the distribution, I construct growth incidence curves that show the growth occurred at each percentile of the distribution of K-12 educational spendings. From 1972 to 2016, a U-shaped pattern is observed with most of the growth in spendings occurring at the bottom and at the top of the distribution of spendings (Figure 3.5). Percentiles below the 30th percentile and above the 75th percentile have increased spendings by more than 100%. This evolution in fact reflect two very different evolutions over time with a decrease in the concentration of spendings from 1972 to 1998 as the less spending percentiles have known the biggest increase over this period –presumably under the influence of school finance reforms– and an increase in the concentration of spendings from 1998 to 2016 as the pattern is totally inverted: the most spendings percentiles have known the biggest increases in per pupil spendings (Figure 3.6).

FIGURE 3.5: Growth incidence curve of per pupil spendings between 1972-2016



Reading: Between 1972 and 2016, per pupil spendings for those at the 80th percentile of the distribution of spendings increased slightly more than 100%.
Sample: 1972 and 2016 School Districts
Sources: *Historical Finances of Individual Governments (IndFin) for 1970-1981 and Public Elementary-Secondary Education Finance Data for 1998-2009, US Census Bureau*

FIGURE 3.6: Growth incidence curve of per pupil spendings between 1972-1998 and 1998-2016



Reading: Between 1972 and 1998, per pupil spendings for those at the 80th percentile of the distribution of spendings increased by around 70%.
Sample: 1972, 1998 and 2016 School Districts
Sources: *Historical Finances of Individual Governments (IndFin) for 1970-1981 and Public Elementary-Secondary Education Finance Data for 1998-2009, US Census Bureau*

CHAPTER 4

HIGHER EDUCATION

In this section, I study the concentration of higher educational investments.

With the data of the Integrated Postsecondary Education Data System (IPEDS), I have information on instructional expenditure and I compute per student instructional expenditure dividing by fall enrollments. This "instructional expenditure" variable is computed in IPEDS separating which part of a university fund goes to research and which part goes to instruction and as so, relies on convention but it is the best proxy for the cost of a college education –part of it being paid by students and their family through tuition fees and part of it being paid by the community through taxes and donations (McPherson and Schapiro [2006])–. Tuition by themselves are a bad proxy for per student spendings as it depends on the level of subsidy which varies a lot between private and public institutions and even within institutions of the same type. Moreover, many public colleges have a big difference between in-state and out-of-state tuitions. As a second specification, I present the evolution of spendings for average total expenditure ¹. This type of expenditure also takes into account student service, academic support, institutional support, research fundings (I only keep half of them), maintenance of buildings and plants. It can be consider that students benefit at least indirectly from having more research fundings in their institution as they have access to better faculty, more resources, better facilities, etc. ²

4.1 Cross-sectional analysis

¹The computation of this category is explained in details in Chapter 2

²I present results based on alternative definitions of spendings (total students oriented resources with or without grants, average public expenditures and average tuition revenue in Appendix A)

TABLE 4.1: Evolution of cost and distribution of instructional expenditure per student from 1980 to 2017 in 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$4,825	\$5,442	\$5,894	\$6,376	\$7,171
Top 0.1 % of students	\$59,310	\$76,390	\$87,237	\$76,869	\$101,513
Percentage of the overall spending	1.62%	1.84%	2.00%	2.05%	2.41%
Top 0.5 % of students	\$27,790	\$32,516	\$43,417	\$50,469	\$52,675
Percentage of the overall spending	4.61%	4.50%	5.51%	6.03%	6.44%
Top 1 % of students	\$19,392	\$22,113	\$27,946	\$33,275	\$39,711
Percentage of the overall spending	6.94%	7.32%	8.29%	8.73%	9.30%
Top 10 % of students	\$8,113	\$9,150	\$10,306	\$11,265	\$12,608
Percentage of the overall spending	27.69%	29.04%	30.93%	32.45%	34.20%
Bottom 50 % of students	\$3,938	\$4,334	\$4,463	\$4,777	\$5,108
Percentage of the overall spending	25.54%	25.01%	24.09%	23.54%	22.54%
Bottom 10 % of students	\$1,716	\$1,902	\$1,975	\$2,107	\$2,287
Percentage of the overall spending	2.97%	2.88%	2.81%	2.84%	2.65%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+145%
Mean of per student spending	\$7,285	\$7,695	\$8,723	\$8,919	84.8%
Top 0.1 % of students	\$91,595	\$108,654	\$128,743	\$130,375	+119%
Percentage of the overall spending	2.11%	1.12%	1.80%	1.13%	
Top 0.5 % of students	\$61,907	\$69,909	\$81,734	\$85,767	+208%
Percentage of the overall spending	6.13%	5.84%	6.23%	6.45%	
Top 1 % of students	\$51,760	\$51,895	\$55,015	\$53,346	+175%
Percentage of the overall spending	9.93%	9.86%	10.48%	10.55%	
Top 10 % of students	\$12,542	\$14,415	\$15,723	\$16,172	+99.3%
Percentage of the overall spending	36.43%	36.2%	36.09%	36.25%	
Bottom 50 % of students	\$4,983	\$5,230	\$5,935	\$5,882	+49.3%
Percentage of the overall spending	21.10%	20.52%	20.72%	20.28%	
Bottom 10 % of students	\$2,271	\$2,369	\$2,571	\$2,561	+49.2%
Percentage of the overall spending	2.48%	2.29%	2.23%	2.15%	

Reading: In 2017, the top 10% of student for whom the most is spent have spendings above \$16,172, they have 36.25% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment Data

In 1980, the mean per student spendings for one year of higher education is \$4,825 in 2017 dollars and \$8,919 in 2017 (Table 4.1). In 1980, the top 1% of students for whom the most is spent have 7.0% of the overall spendings (compared to around 3.0% for K-12 education), the top 10% has 27.7% of the overall spendings (compared to 20%), the bottom 50% have 25.5% of the spendings (compared to 40%) and the bottom 10% has 3.0% of the overall spendings (compared to 7%).

Spendings are thus far more unequally distributed at the higher education level than at the elementary and secondary levels. Contrary to the distribution of elementary and secondary per pupil spendings where little evolution is seen over the period, the distribution of per student instructional expenditure have known a significant increase in inequalities from 1980 to 2017. Indeed, average student spendings have increased by 85% in real terms whereas spendings for the top 1% have increased by 175% and spendings for the median student have only increased by around 50%.

4.2 Longitudinal analysis

I use the different sectors of institutions to compute inequalities in spendings arising from different lengths of studies. Comparing with the cross-sectional distribution of spendings, the longitudinal one could be more equal (if shorter training are more expensive per year) or more unequal (if the reverse is true). I assume that students enrolled in any "less-than-2-year" institutions received one year of higher education; those enrolled in "2-year" received two years and those enrolled in "4-year" received 4 years of higher education which is an approximation as some students are going to 4-year college and then dropping before the end –so that my estimates of the inequality level would be biased upward– and others are going to community colleges and then transferring to 4-year colleges –so that my estimate of the inequality level would be biased downward–. This distribution should then be considered as a theoretical distribution prevailing if any student was doing the length of studies of the first institution (s)he is enrolled in.

In 1980, the mean per student spendings for higher education is \$17,763 in 2017 dollars (Table 4.2). It is \$33,965 in 2017. In 1980, the top 1% of students for whom the most is spent have 7.6% of the overall spendings (compared to 7.0% in the cross-sectional analysis), the top 10% has 30.0% of the overall spendings (compared to 27.7%), the bottom 50% have 19.4% of the spendings (compared to 25.5%) and the bottom 10% has 1.7% of the overall spendings (compared to 3.0% in the cross-sectional analysis).

TABLE 4.2: Evolution of cost and distribution of instructional expenditure per student from 1980 to 2017 in 2017 dollars (longitudinal analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$17,763	\$20,083	\$21,711	\$23,433	\$26,113
Top 0.1 % of students	\$237,547	\$306,163	\$350,024	\$308,256	\$395,462
Percentage of the overall spending	1.78%	2%	2.18%	2.25%	2.19%
Top 0.5 % of students	\$111,306	\$130,321	\$174,206	\$177,310	\$210,892
Percentage of the overall spending	5.01%	4.90%	5.92%	7.21%	6.15%
Top 1 % of students	\$77,667	\$88,626	\$112,130	\$127,419	\$158,987
Percentage of the overall spending	7.57%	7.96%	8.98%	9.73%	9.28%
Top 10 % of students	\$32,493	\$36,674	\$41,350	\$45,174	\$50,365
Percentage of the overall spending	30.04%	31.5%	33.59%	35.25%	36.84%
Bottom 50 % of students	\$15,296	\$16,825	\$17,269	\$18,316	\$19,482
Percentage of the overall spending	19.44%	18.95%	17.48%	17.11%	16.36%
Bottom 10 % of students	\$3,509	\$3,908	\$4,044	\$4,349	\$4,601
Percentage of the overall spending	1.68%	1.61%	1.57%	1.62%	1.44%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+145%
Mean of per student spending	\$26,717	\$28,662	\$33,101	\$33,965	+91.2%
Top 0.1 % of students	\$366,072	\$434,692	\$543,631	\$521,498	+ 119%
Percentage of the overall spending	1.82%	1.25%	0.97%	1.27%	
Top 0.5 % of students	\$247,418	\$281,921	\$321,646	\$327,399	+ 194%
Percentage of the overall spending	6.14%	6.36%	7.67%	7.42%	
Top 1 % of students	\$206,867	\$212,451	\$230,018	\$230,202	+ 196%
Percentage of the overall spending	10.40%	10.72%	11.27%	11.39%	
Top 10 % of students	\$50,247	\$57,918	\$64,345	\$66,076	+ 103%
Percentage of the overall spending	39.43%	39.34%	38.95%	39.13%	
Bottom 50 % of students	\$18,991	\$19,520	\$22,993	\$23,239	+ 52%
Percentage of the overall spending	14.56%	13.31%	14.21%	14.14%	
Bottom 10 % of students	\$4,629	\$4,922	\$5,743	\$5,717	+ 63%
Percentage of the overall spending	1.41%	1.39%	1.46%	1.42%	

Reading: In 2017, the top 10% of student for whom the most is spent the more have spendings above \$66,076, they have 39.13% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment data

Longitudinal spendings are more unequally distributed than cross-sectional one because longer trainings (4-year colleges and universities) also tend to be the ones spending the most per year. This is particularly true in the bottom half of the distribution where people having lower per year spendings also tend to be in shorter curriculum. Mean student spendings have increased by 91% in real terms whereas spendings for the top 1% have increased by almost 200% and spendings for the median student have only increased by around 50%. In the bottom half of the distribution, increase in real terms for longitudinal spendings and for cross-sectional spendings are comparable whereas in the top half of the distribution, increase are higher for the longitudinal distribution than for the cross-sectional one.

4.3 Average Total Expenditure (including half of research expenditure)

Focusing on the distribution computed with average total expenditure³ (Table 4.3), the level of inequalities are similar, sometimes a bit smaller than with instructional spendings only. This shows that spendings not included in instructional spendings such as research (only half of it is included in my average total expenditure variable), student and public services, academic support, maintenance and operation of buildings are a bit less concentrated than spendings for instruction. As for instructional spendings, over the period, higher deciles have known the biggest increase in total average spendings (+104% for the top 1%) whereas the median has known the smallest increase over the past four decades (+47% only).

³Distribution with other definition of spendings are presented in Appendix A.

TABLE 4.3: Evolution of cost and distribution of average total expenditure per student from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$13,080	\$15,358	\$16,540	\$18,307	\$19,977
Top 0.1 % of students	\$149,637	\$181,658	\$211,158	\$229,153	\$298,723
Percentage of the overall spending	1.41%	1.57%	1.90%	1.75%	3.25%
Top 0.5 % of students	\$75,845	\$95,213	\$106,930	\$108,438	\$140,285
Percentage of the overall spending	3.94%	4.51%	4.92%	4.86%	6.42%
Top 1 % of students	\$68,245	\$71,332	\$82,499	\$93,353	\$111,245
Percentage of the overall spending	6.69%	7.30%	7.63%	7.61%	9.22%
Top 10 % of students	\$23,756	\$27,492	\$31,006	\$34,011	\$35,565
Percentage of the overall spending	29.72%	30.42%	31.87%	32.40%	34.36%
Bottom 50 % of students	\$103,14	\$11,683	\$11,932	\$13,080	\$14,091
Percentage of the overall spending	22.54%	22.35%	21.52%	21.35%	21.04%
Bottom 10 % of students	\$3,772	\$4,410	\$4,805	\$5,373	\$5,783
Percentage of the overall spending	2.46%	2.34%	2.39%	2.49%	2.33%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+145%
Mean of per student spending	\$19,996	\$19,684	\$22,117	\$23,181	+77.2%
Top 0.1 % of students	\$237,455	\$223,777	\$248,432	\$267,058	+78.4%
Percentage of the overall spending	2.16%	1.92%	1.64%	1.71%	
Top 0.5 % of students	\$142,488	\$149,477	\$158,242	\$165,751	+118%
Percentage of the overall spending	5.40%	5.63%	5.73%	5.78%	
Top 1 % of students	\$122,594	\$127,522	\$137,484	\$139,443	+104%
Percentage of the overall spending	8.93%	8.77%	8.90%	9.09%	
Top 10 % of students	\$37,125	\$37,885	\$41,600	\$45,118	+89.9%
Percentage of the overall spending	34.84%	35.47%	35.16%	35.44%	
Bottom 50 % of students	\$13,427	\$13,053	\$14,413	\$15,209	+47.4%
Percentage of the overall spending	20.45%	20.22%	20.5%	20.23%	
Bottom 10 % of students	\$5,938	\$5,723	\$6,703	\$6,582	+74.4%
Percentage of the overall spending	2.43%	2.45%	2.50%	2.44%	

Reading: In 2017, the top 10% of student for whom the most is spent have average total spendings above \$45,118, they have 35.44% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

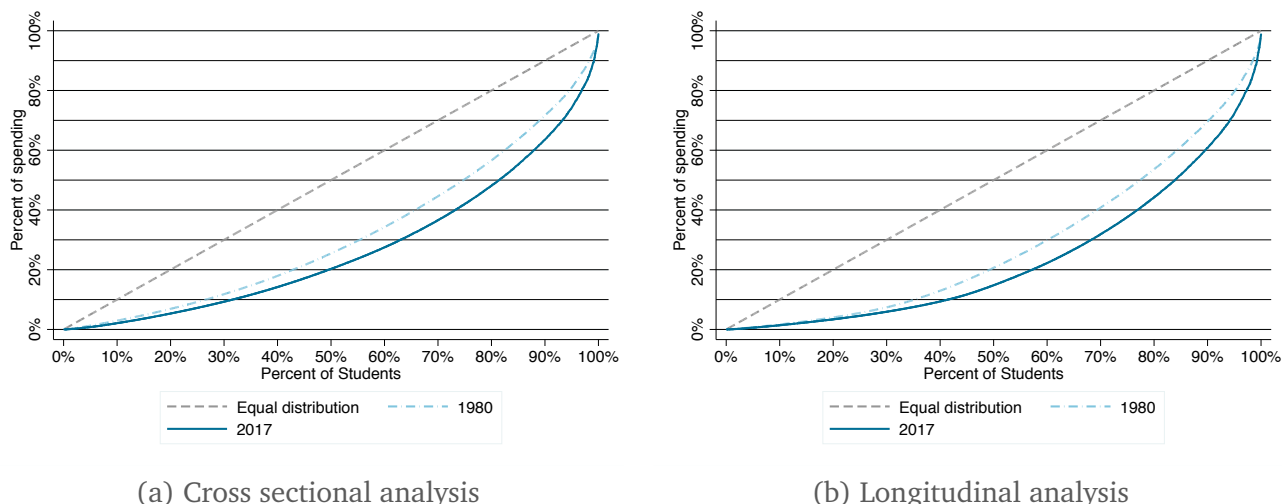
N.B.: Average total spendings also include spendings for research (half of them) and as such, don't only represent educational expenditure

Sources: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment Data

4.4 Evolution over time

Between 1980 and 2017, a big increase in the variance of instructional expenditures is observed: these expenditure have increased a lot for the higher deciles whereas there has been little evolution for the lower deciles of spendings.

FIGURE 4.1: Lorenz Curve of per student Spendings for instruction in 1980 and 2017



Sample: 1980 and 2017 Colleges and Universities

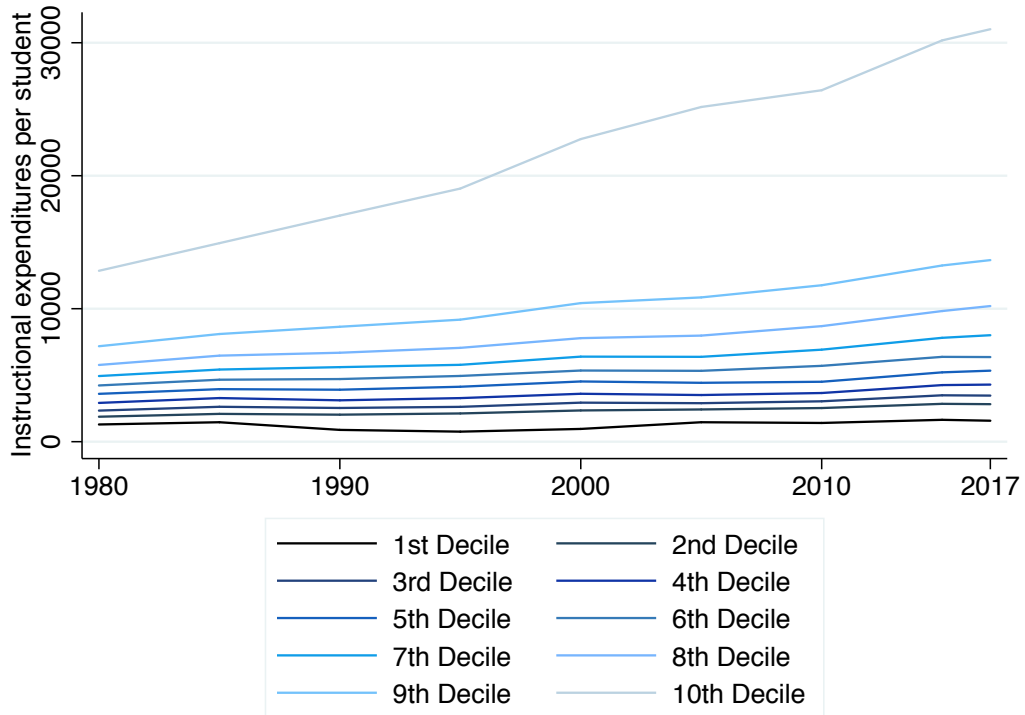
Sources: *IPEDS, Finance and Enrollment Data*

N.B.: For the longitudinal analysis, I made the assumption that everyone is getting one year of higher education in less than two-years institutions, two years of higher education in two-years institutions and four years of higher education in four-years institutions which is a theoretical distribution of the length of studies

Lorenz curves of instructional expenditures for higher education show the increase in inequalities in spendings from 1980 to 2017, increase being higher for the longitudinal analysis (Figure 4.1). Computing the evolution of per student instructional expenditures per decile of spendings, the higher decile of spendings is the one having most of the increase in expenditures over the period (Figure 4.2). We observe a divergence in instructional spendings and a higher stratification of spendings between institutions. Hoxby [2009], showed that between 1966 and 2006, most of the increase in Student-Oriented resources and Average Subsidy per Student occurred in the most selective institutions causing a higher stratification of institutions in higher education.

As for K-12 education, I construct growth incidence curves to see which percentile of the distribution has known the biggest increase in spendings (Figure 4.3). With instructional expenditure, the growth incidence curve is increasing all along the distribution of spendings: the highest percentiles of spendings have known the biggest increase over the period. The pattern is slightly different with average total expenditure as those at the bottom of the distribution have known bigger increase in expenditures than those in the middle even if the main increase in expenditures occurred at the top with more than 100% increase for those above the 90th percentile of spendings. This is consistent with the finding (Jacob et al. [2018]) that less selective institutions have increased more extra-curricular spendings (student service, academic support...) than core instruction spendings.

FIGURE 4.2: Evolution of per student instructional expenditure per decile of spendings between 1980 and 2017 - in constant 2017 dollars

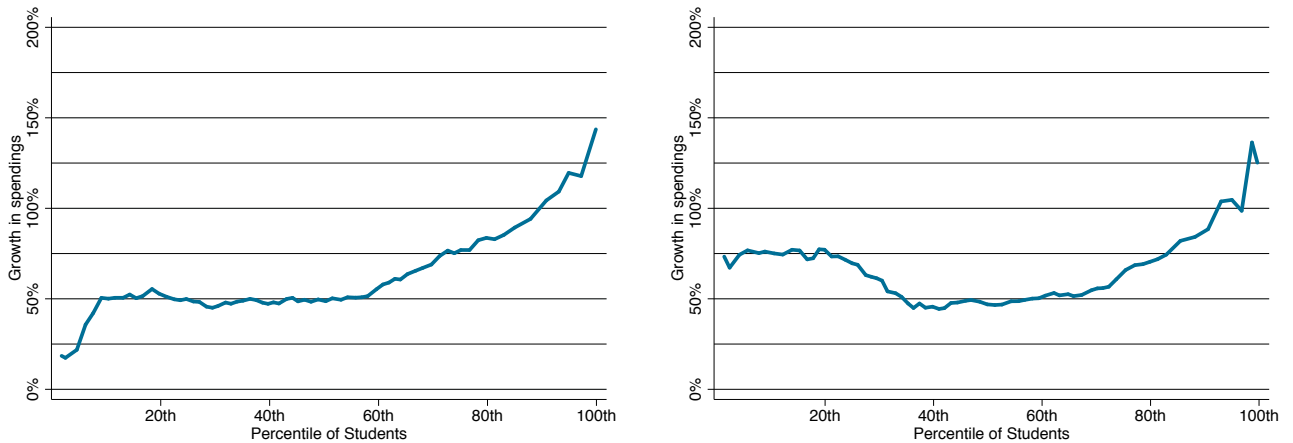


Reading: Instructional expenditure per student per year have increased from \$13,000 in 1980 to \$31,000 in 2017 for students in the 10th decile of spendings.

Sample: 1980 to 2017 Colleges and Universities

Sources: IPEDS Data, Finance and Enrollment survey

FIGURE 4.3: Growth incidence curve of per student spendings from 1980 to 2017



(a) Instructional Expenditure per Student

(b) Average Total Expenditure per Student

Reading: Between 1980 and 2017, per student instructional spendings increased by around 100% for those at the 90th percentile of the distribution of spendings.

Sample: 1980 and 2017 Colleges and Universities

Sources: IPEDS Data, Finance and Enrollment surveys

CHAPTER 5

SCENARIOS OF GLOBAL INEQUALITIES IN EDUCATIONAL SPENDINGS

Not having individual data, I don't know where have studied the one who have longer studies. In this section, I compute global inequalities in spendings based on two hypotheses: the first one assumes that dropouts are uniformly distributed among all the deciles of spendings –it can be considered as a lower bound for inequalities in spendings– and the second one assumes that dropouts are concentrated among the lowest spending districts –it can be considered as an upper bound for inequalities in spendings–.

5.1 Presentation of the computation of the length of studies

5.1.1 K-12 Education

My first cohort studied is the 1964 cohort as individuals born this year are entering elementary education in 1970, where my data on per district spendings starts continuously. My last cohort is the one entering first grade in 2005 as they reach higher education in 2017, the last year of my data. I don't take into account repeaters.

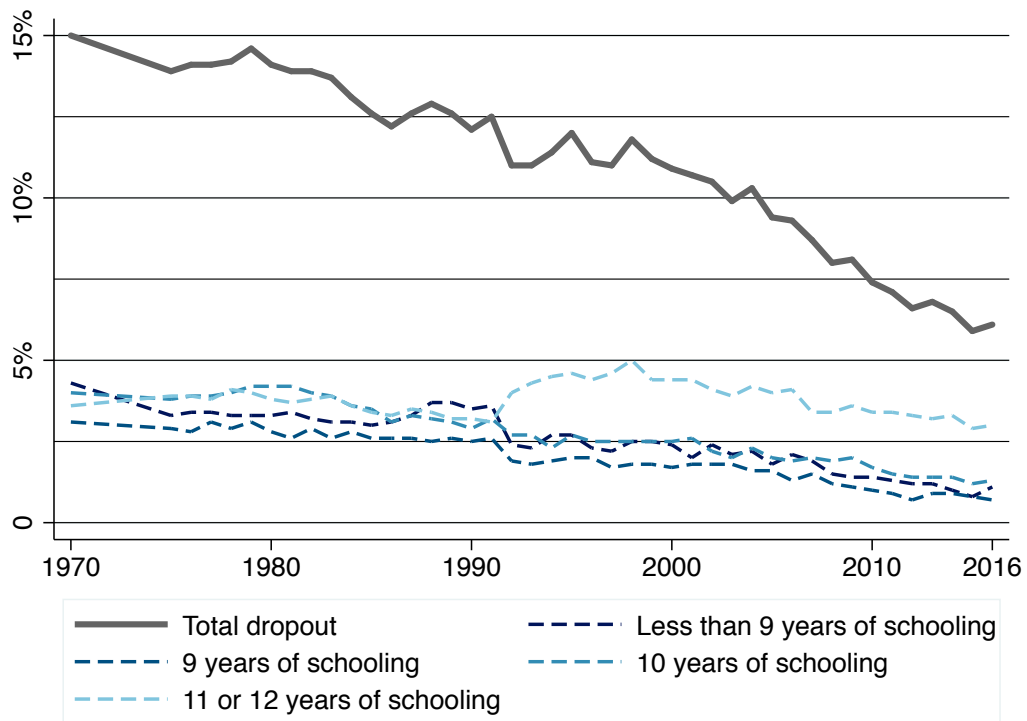
As data on dropout per district (Common Core Data, NCES) only exist starting in 2009 and is only present for around 13% of the districts, I use average dropout data from NCES statistics making two assumptions on the distribution of dropouts along the distribution of spendings (Figure 5.1) ¹.

5.1.2 Higher Education

To know which percentage of a cohort is going to higher education, I multiply the proportion of High School graduates by the proportion of High School graduates that enroll in college (based on NCES data), this is the same source as the source of droupouts (Table 5.1).

¹See next section for more details on the hypotheses

FIGURE 5.1: Percent of High school Dropout from 1970 to 2016



Reading: In 2016, there are 6% of High School Dropouts.

Sources: National Center for Education Statistics based on U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October, 1970 through 2016.

TABLE 5.1: Distribution of college goers for the cohort studied

Year Of First Grade	High School Graduate As a percent of 17 years old	Percent of High School graduates Going to College	Percent of the cohort Going to college
1970	72.4%	50.6%	36.7%
1973	72.4%	57.7%	41.8%
1978	73.4%	60.1%	44.2%
1980	73.0%	61.8%	45.2%
1983	69.3%	61.9%	42.9%
1988	69.8%	63.3%	44.2%
1990	72.2%	65.2%	47.1%
1993	75.4%	68.6%	51.7%
1998	79.8%	68.1%	54.3%
2000	80.5%	66.2%	53.3%
2003	84.6%	69.2%	58.6%
2005	85.3%	66.7%	56.9%

Reading: For the cohort entering in first grade in 1970, 36.7% of individuals went to higher education.

Sources: *NCES based on U.S. Department of Commerce, Census Bureau, Historical Statistics of the United States, Colonial Times to 1970; Current Population Reports, Series P-20, various years; CPS Historical Time Series Tables on School Enrollment, 2017)*

I only focus on associate degree, bachelor degree and master degree as spendings for Ph.D. students respond to a different logic than the ones for lower level of education. For higher education, starting from 2005, I have completion data in IPEDS: I compute an average length of studies for associate degree, bachelor degree and master degree per institution as explained in Chapter 2.

5.2 Presentation of the hypotheses

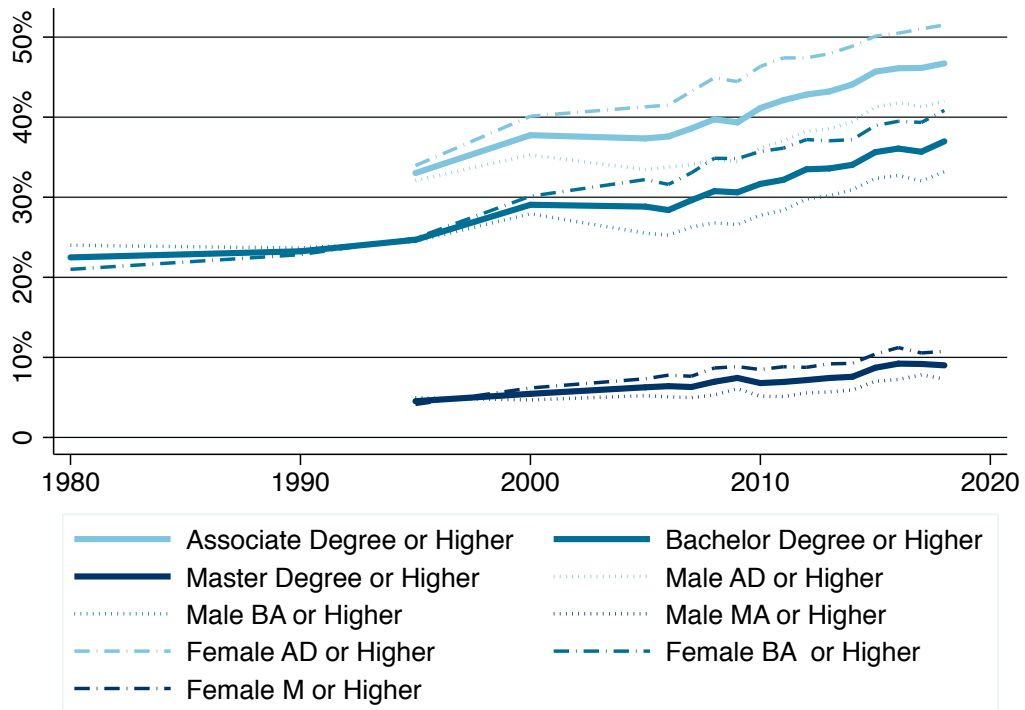
5.2.1 First Scenario: Lower bound for inequalities

In the first scenario, I make the assumption that the variance of spendings for a given year is equally distributed among the different lengths of studies: alternatively said, it means than among those who drop after 10th grade, 1% have been in the 1th percentile of spendings, 1% in the 99th percentile of spendings and so on. It is very likely that inequality levels computed this way are lower bounds for inequalities in spendings as the one getting the most expansive primary and secondary education are more likely to stay enrolled longer. Indeed, many studies showed the positive impact of student aids on completion and retainment (Bettinger [2004]; Kane [2006]; Deming and Dynarski [2010], Fack and Grenet [2015]) or the impact of public spendings on retainment and graduation (Card and Krueger [1996], Deming and Walters [2017])

5.2.2 Second Scenario: Upper bound for inequalities

In a second scenario, I assume that all the dropouts are concentrated among the less spendings deciles: it means that the 3.4% of students dropping after 8th grade in the 1970's are the 3.4 lowest deciles of spendings, the 2.9% of students dropping after 9th grade in the 1970's are the 2.9 following lowest deciles of spendings and so on. Then I match the college distribution to the highest spendings

FIGURE 5.2: Percent of Associate Degree, Bachelor Degree and Master Degree or higher by gender and over time



Reading: In 2017, 46% of individuals have an associate degree or higher.

Sources: National Center for Education Statistics based on U.S. Department of Commerce, Census Bureau, U.S. Census of Population: 1960, Vol. I, Part 1; J.K. Folger and C.B. Nam, Education of the American Population (1960 Census Monograph); Current Population Reports, Series P-20, various years; and Current Population Survey (CPS), Annual Social and Economic Supplement, 1970 through 2018

decile corresponding to the proportion of college goers. For instance, in the 1970's, 36.7% of individuals go to college, I assume that they had elementary and secondary education in the highest spendings districts. This hypothesis changes the distribution of spendings through elementary and secondary schooling and through who are the one going to college as I maintain the length of studies computed with completion and graduation data from IPEDS for college education.

5.3 Results

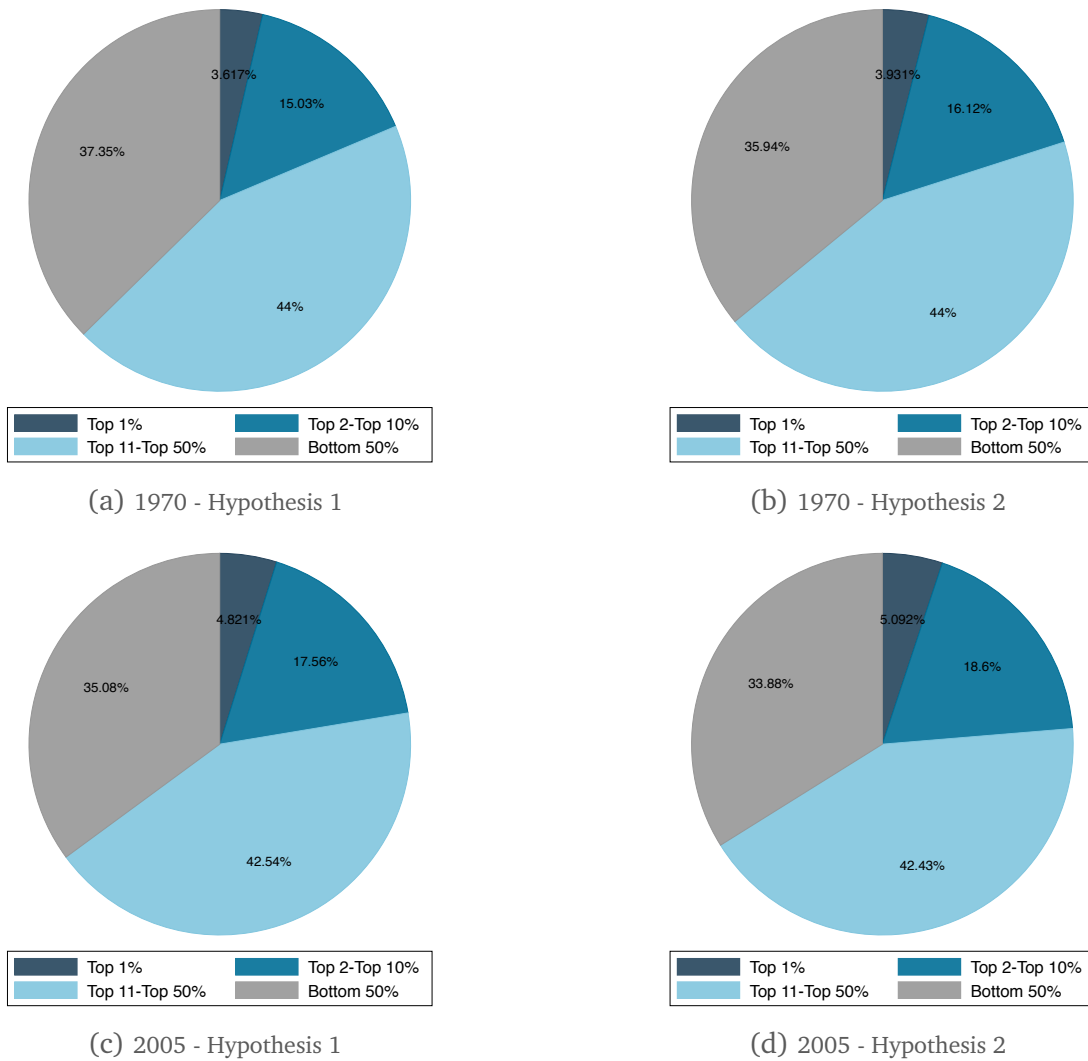
5.3.1 With instructional Expenditures

The main specification focuses on instructional expenditures for the cohorts entering first grade in 1970, 1998 and 2005 ². Overall, as we would expect given the fact that educational spendings 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% seems to have increased over time whereas the one of the bottom 50 have slightly decrease (Table 5.2). The top 10 used to have between 18.6 % (hypothesis 1) and 20.0% (hypothesis 2) in the 1970's and has between 22.3% and 23.6 % in the 2000's. The bottom 50 used to have between 35.9% (hypothesis 2) and 37.3% (hypothesis 1) in the 1970's and has between 33.8% and 35.0% in the 2000's. Nevertheless, the one of the bottom 10 has slightly increased: they used to have between 4.52% (hypothesis 2) and 5.70% (hypothesis 1) in the 1970's and have between 5.33% and 5.83 % in the 2000's. This is consistent with the fact that higher education spendings have increase the less for students located at the median of spendings.

This is striking to observe than besides the big differences in the two hypotheses I made (dropouts distributed uniformly among the spendings or among the less spending deciles), the distribution are quite similar. As expected, when dropouts are concentrated in the less spendings decile, the distribution is more unequal as the same individuals have both less spendings per year and less years of education. Nevertheless, the order of magnitude stay the same as there is an enormous variance in spendings 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.

²Results for intermediary years are presented in Appendix C

FIGURE 5.3: Shares of spendings for the entire educational career with instructional spendings



Reading: The Bottom 50% of individual for whom the less is invested in education have around 35% of the overall spendings.

Sample: Cohorts entering first grade in 1970 and 2005

N.B.: Spendings for K-12 education are educational spendings whereas spendings for higher education are instructional spendings only.

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

TABLE 5.2: Distribution of spendings with instructional spendings for higher education

1970 cohort - Instructional expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$83,584		\$83,584
Top 0.1%	0.97%	\$373,517	1.06%	\$396,463
Top 0.5%	2.33%	\$242,923	2.52%	\$259,883
Top 1%	3.62%	\$197,963	3.94%	\$220,191
Top 10%	18.6%	\$115,236	20.0%	\$123,789
Bottom 50%	37.3%	\$76,231	35.9%	\$75,045
Bottom 10%	5.70%	\$52,919	4.52%	\$46,306

1998 cohort - Instructional expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$145,294		\$145,294
Top 0.1%	0.81%	\$877,848	0.99%	\$1,088,255
Top 0.5%	2.74%	\$587,832	2.98%	\$605,833
Top 1%	4.49%	\$446,787	4.75%	\$451,286
Top 10%	21.2%	\$210,263	22.5%	\$227,501
Bottom 50%	36.0%	\$124,576	34.5%	\$118,725
Bottom 10%	5.67%	\$95,597	5.04%	\$98,070

2005 cohort - Instructional expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$157,726		\$157,726
Top 0.1%	0.92%	\$1,088,760	1.09%	\$1,209,266
Top 0.5%	3.01%	\$647,892	3.25%	\$650,969
Top 1%	4.78%	\$485,372	5.05%	\$503,081
Top 10%	22.3%	\$239,435	23.6%	\$253,120
Bottom 50%	35.0%	\$129,669	33.8%	\$126,128
Bottom 10%	5.83%	\$102,115	5.33%	\$101,878

Reading: Among those that entered first grade in 1970, the bottom 50 percent of spendings had spendings between \$75,045 (hypothesis 2) and \$76,231 (hypothesis 1). They had between 35.9% and 37.3% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 1998-2005 School Districts and 2005 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditures only.

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

5.3.2 With average total expenditures

As a second specification, I focus on average total expenditures for the cohorts entering first grade in 1970, 1998 and 2005. As highlighted in the higher education case, total expenditures also include fundings for research (I included half of research expenditures) but it can be considered that students benefit partly from these spendings. Moreover, this is more consistent with the definition of spendings considered for elementary education as I included total educational ones for K-12 education and not only instructional spendings. Focusing on average total expenditure, the picture is a little different as the distribution of expenditure is more unequal and has increased more over time (Table 5.3): the share of the top 10% was between 23.6% (hypothesis 1) and 25.5% (hypothesis 2) –compared to between 18.6% and 20% for instructional expenditure– for the cohort entering first grade in 1970 and between 28.1% and 29.6% for the cohort entering first grade in 2005 –compared to between 22.3% and 23.6%–. The share of top 1% is also a bit higher, at the expense of the one of the Bottom 50% and Bottom 10%. This is not explained by the fact that average total expenditure are more unequally distributed (as we saw in the Chapter 4 that they are even slightly more equally distributed) but by the fact that average total expenditures represent bigger amount than instructional expenditures and as higher educational spendings are far more unequally distributed than elementary and secondary ones, when they represent a bigger proportion of the total of spendings, inequalities are higher. Similarly, as inequalities in higher education have increased and inequalities in K-12 education are stable, when the former represent a bigger amount of the total of spendings than the latter, the global level of inequalities increase more.

TABLE 5.3: Distribution of spendings with average total expenditure for higher education

1970 cohort - Average total expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$95,623		\$95,623
Top 0.1 %	1.08%	\$660,094	1.43%	\$668,836
Top 0.5 %	3.27%	\$415,233	3.63%	\$433,462
Top 1 %	5.19%	\$321,810	5.65%	\$343,363
Top 10 %	23.6%	\$150,169	25.5%	\$163,209
Bottom 50 %	33.1%	\$78,109	31.4%	\$75,045
Bottom 10 %	5.05%	\$53,936	3.95%	\$46,306

1998 cohort - Average total expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$169,502		\$169,502
Top 0.1 %	1.31%	\$1,481,826	1.55%	\$1,712,346
Top 0.5 %	3.98%	\$922,375	4.29%	\$947,752
Top 1 %	6.32%	\$689,858	6.68%	\$704,177
Top 10 %	26.6%	\$273,354	28.0%	\$298,278
Bottom 50 %	31.6%	\$124,475	29.9%	\$123,174
Bottom 10 %	5.20%	\$98,211	4.50%	\$98,070

2005 cohort - Average total expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$192,740		\$192,740
Top 0.1 %	1.50%	\$1,805,515	1.68%	\$1,960,041
Top 0.5 %	4.22%	\$1,087,118	4.49%	\$1,123,995
Top 1 %	6.68%	\$825,583	7.00%	\$847,958
Top 10 %	28.1%	\$321,673	29.6%	\$348,563
Bottom 50 %	29.7%	\$138,088	27.9%	\$133,169
Bottom 10 %	4.87%	\$103,981	4.36%	\$101,878

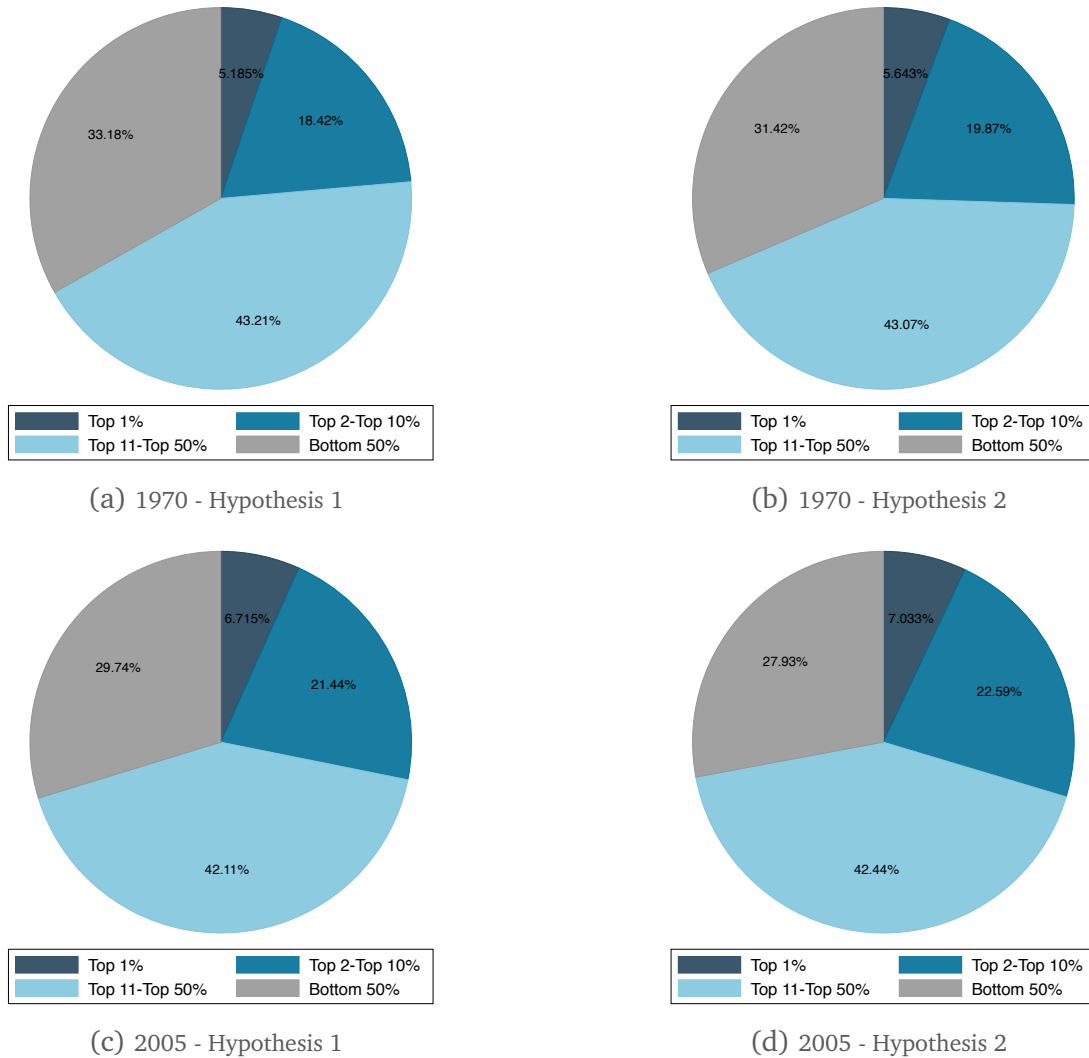
Reading: Among those that entered first grade in 2005, the bottom 50 percent of spendings had spendings between \$133,169 (hypothesis 2) and \$138,088 (hypothesis 1). They had between 27.9% and 29.7% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 1998-2005 School Districts and 2005 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are total expenditures (also include half of research expenditures).

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

FIGURE 5.4: Shares of spendings for the entire educational career with average total expenditures



Reading: In 1970, the Bottom 50% of individual for whom the less is invested in education have around 30% of the overall spendings.

Sample: Cohorts entering first grade in 1970 and 2005

N.B.: Spendings for K-12 education are educational spendings whereas spendings for higher education are average total expenditures (include half of research expenditure).

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

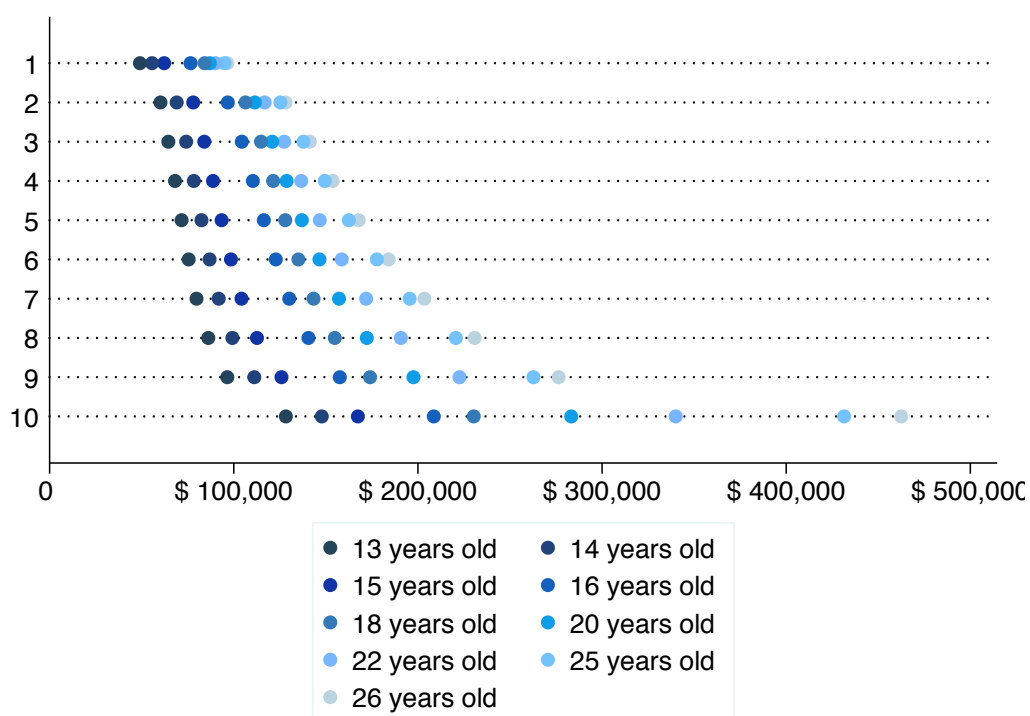
5.3.3 Some elements of comparison over time

The global distributions represented with pie charts (Figure 5.3 and Figure 5.4) don't take into account the fact that some individuals are big spenders because they have long studies and other are because they have high spendings in each grade compared to others.

The following decile representation shows that someone being all over its educational career in the 10th decile of spendings always have more spendings than someone always in the 1st decile of spendings even if the first individual only stops after 8th grade whereas the other goes to graduate studies (Figure 5.5). It seems that the variance in spending per grade explains more of the disparities

in spendings than the length of studies, something that I explore more in Chapter 7. Mechanically, I observe that the higher the decile of spendings, the higher the variance coming from difference length of studies: there is more heterogeneity among big spenders.

FIGURE 5.5: Average spendings (in 2017 dollars) per decile of spendings depending on the number of years still at school for the 1998 cohort



Reading: For the 1998 cohort, average educational spendings for individuals in the 10th decile of spendings staying in school until 22 years old are around \$340,000.

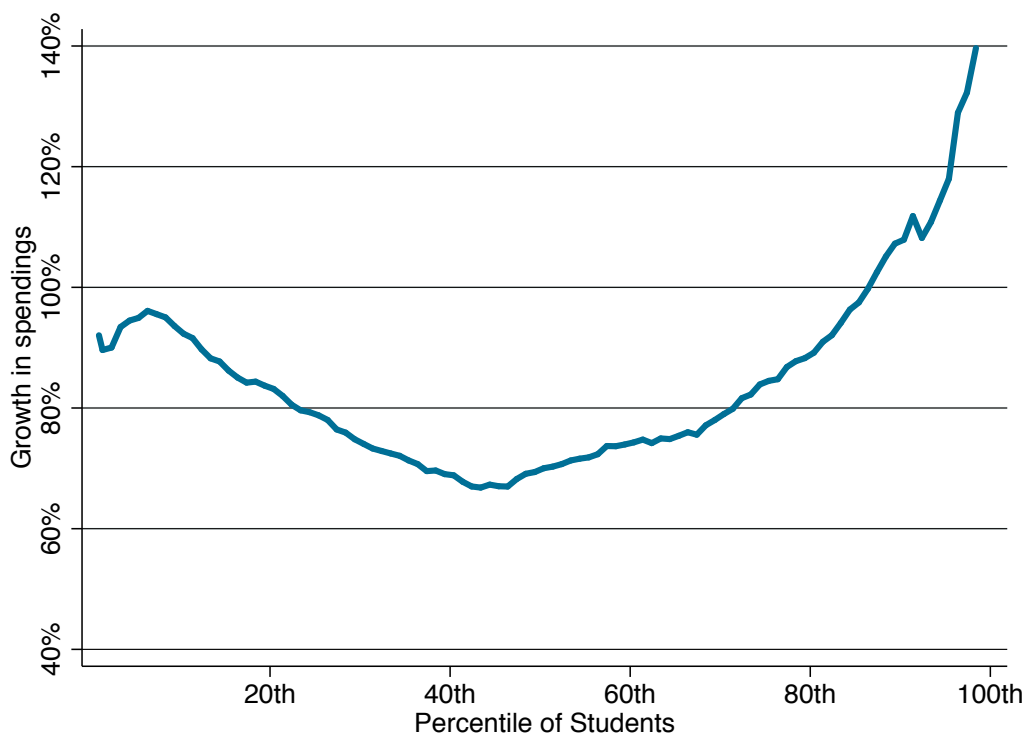
Sample: 1998- 2009 School Districts and 2010 colleges

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditures only.

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

As for K-12 and Higher Education, I compute growth incidence curves of spendings. The curve has a U-shaped pattern with most of the increase in expenditures occurring at the bottom and at the top of the distribution. This pattern leads to something very similar to the "elephant curve" found by Milanovic [2016] for the growth of income. Only people above the 90th percentile of spendings have known an increase in expenditures higher than 100% over the past four decades.

FIGURE 5.6: Growth incidence curve of educational spendings from the 1970's to the 2000's



Reading: Between the 1970's and 2000's, per pupil spendings for education increased by around 100% for those at the 90th percentile of expenditures.

Sample: 1970-1981 and 2005-2017 School Districts, 1980 and 2017 Colleges and Universities

N.B.: Computations are made based on instruction per student for higher education and hypothesis 1 of combination of inequalities in K-12 and Higher Education, results with average total expenditure follow the same pattern

Sources: *Historical Finances of Individual Governments (IndFin) for 1970-1981, Public Elementary-Secondary Education Finance Data for 1998-2009, US Census Bureau and IPEDS Data, Finance and Enrollment surveys*

CHAPTER 6

SOME ELEMENTS OF COMPARISON

It can be interesting to compare the distribution of educational investments to wage distribution, on the one hand, and to other countries distribution, on the other hand.

This is impossible to compare directly with results from France because spendings data in France are presented aggregated, often at the country level. There is no equivalent of the Public Elementary-Secondary Education Finance Data for K-12 education (that would present spendings at the city level for elementary school, department level for middle school and region level for high-school) or of IPEDS survey for Higher Education. I thus present some elements of comparison based on aggregated statistics (average educational attainment, average spendings per level...) and computations made in a previous master thesis by Zuber [2003] with French data.

6.1 Comparison France/US

At the global level, both France and the US dedicate around 6.7 % of their GDP to educational spendings. The structure of these spendings is different as in France, the state sustains 71% of educational spendings, regions 9%, department 5% and towns 15% whereas in the US, the federal government bears 8% of the cost of education, the state 47% and local government 45%.

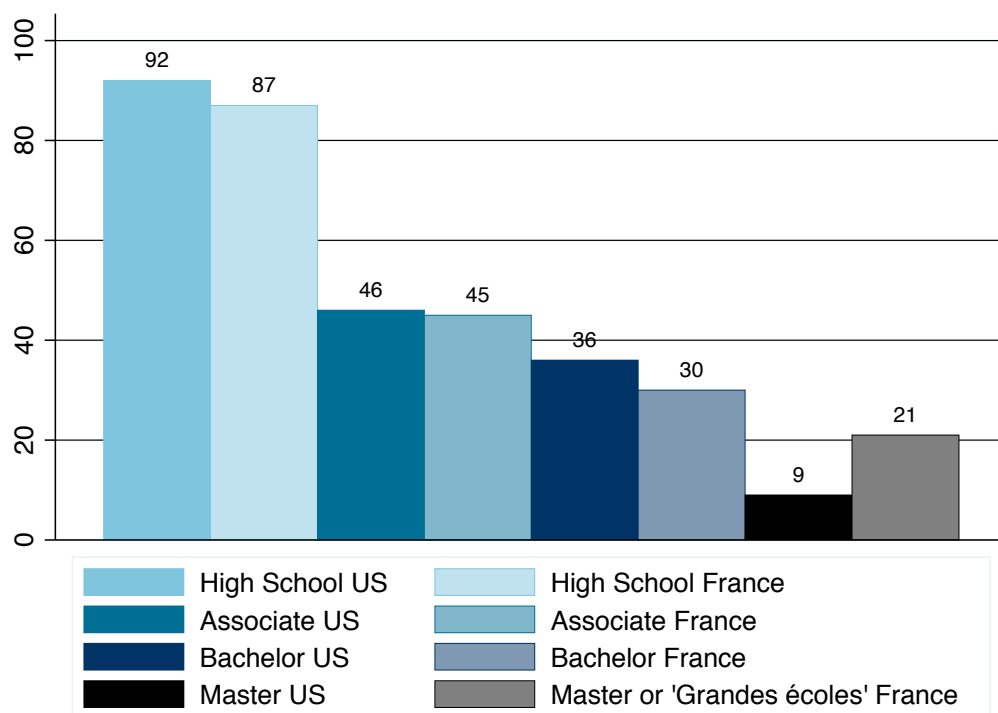
Educational attainment in France and in the US are quite similar (Figure 6.1) with the percentage of high schools graduates, associate degree graduates and bachelor graduates being a bit higher in the US while France has more master graduates (21% have fulfilled a master degree or belong to a *Grande école* against 9% having a master degree in the US).

Average spendings are higher in the US for every level of education (Figure 6.2), this is particularly notable for private higher education institutions.

6.1.1 Elementary and Secondary Education

In France, the system of elementary and secondary education is more centralized than in the US, thus lowering inequalities in spendings within a particular grade. Some reports (Métayer [2017]) have shown that the budget allocated by the state hasn't changed much in the past ten years but that spendings made by *collectivités territoriales* (regional government) aren't uniformly distributed around the country. Departments give an average of 1,500 euros per middle school student but there is a

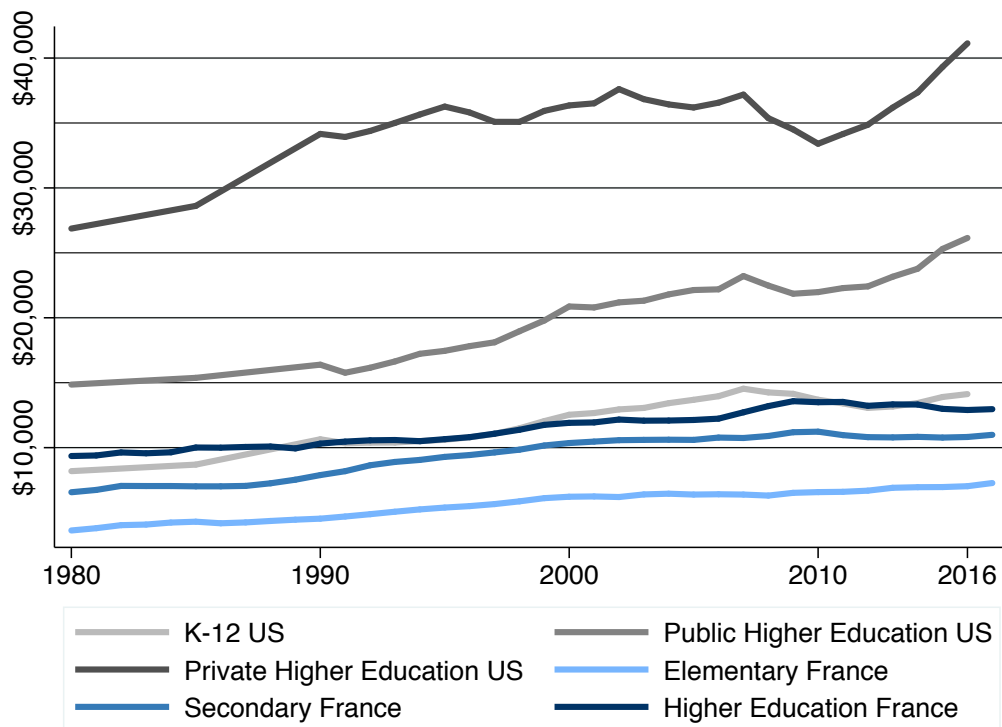
FIGURE 6.1: Level of educational attainment in France and in the US in 2016



Reading: In 2016, 46% of US students have an associate degree or an higher degree.

Sources: NCES for the US and DEPP for France

FIGURE 6.2: Average spendings per level of education in France and in the US (in 2017 dollars)



Reading: In 1980, average per student spendings in US public universities were 15,000 dollars.

N.B.: I converted French spendings in dollars using the average exchange rate over the period so that evolutions are invariant to variations in the exchange rate.

Sources: NCES for the US and DEPP for France

lot of heterogeneity. In some departments, middle school students have between than 10,000 and 15,000 euros of global investment each year (*Bouche-du-Rhône, Hautes-Alpes, Isère, Hauts de Seine, Val de Marne, Nord, Haute Marne, Doubs, Landes, Loiret*) while others have less than 5,100 euros (*Haute Pyrénées, Aveyron, Lozère, Cantal, Haute Loire, Lot et Garonne, Corrèze, Creuse, Cher, Charente-Maritime, Charente, Indre et Loire, Morbihan, Ile et Villaine, Mayenne, Manche, Calvados, Ardenne, Eure et Loire, Meurthe et Moselle, Ardèche, Loire*). There is also an heterogeneity in investment made by regions for high school students: in 2011, *Languedoc Roussillon* and *Limousin* invested more than 3,000 euros per student against 1,000 in *Guyane*, or 2,000 euros in *Pays de la Loire* for instance. Nevertheless, there is no centralized school finance survey for K-12 education that would allow to study easily heterogeneity in spendings within a particular grade. The comparison with the US is difficult because the heterogeneity in spendings is determined by the level of aggregation of the data: whether the data is presented at the school level, district level (in the US), department level, region level or country level (in France) determines the heterogeneity in spendings within a particular grade. Some authors (Benhenda [2019]) have showned that there is a big heterogeneity in spendings between disadvantaged and others schools with teachers being better paid in non-disadvantaged schools but average spendings being higher in disadvantaged schools due to lower teacher-pupil ratio.

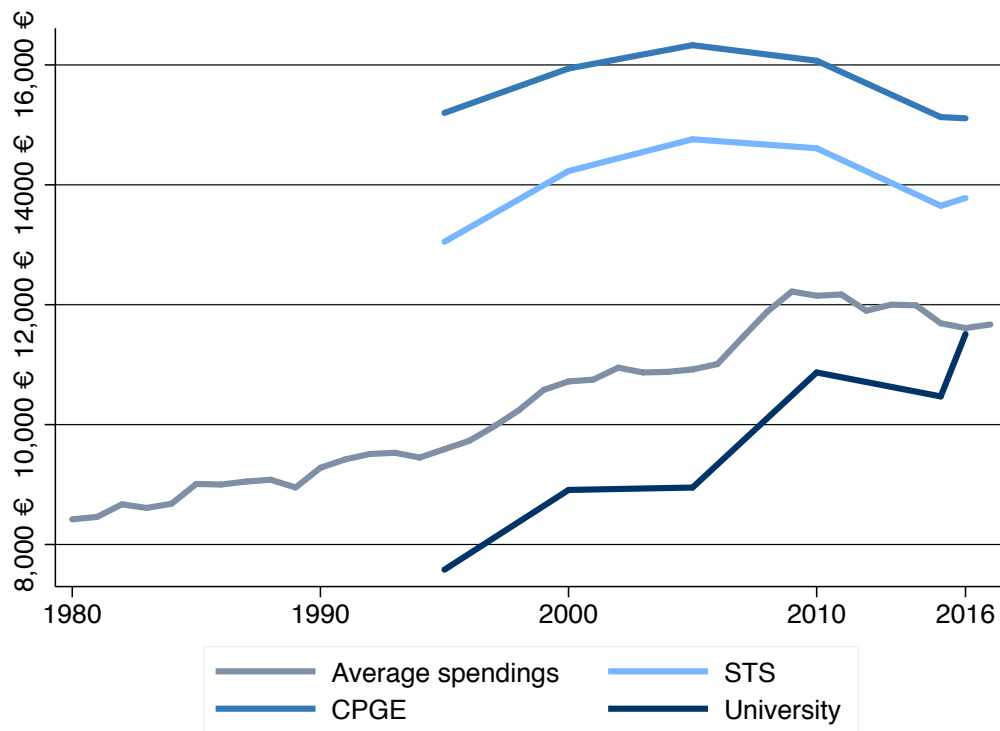
6.1.2 Higher Education

In France, there is no survey equivalent to IPEDS that would centralize spendings data of all universities and higher education institutions. For undergraduate studies, there is an heterogeneity in spendings (Figure 6.3) coming from the fact that some curriculum (*CPGE*¹, *STS*²) are spending more on students than others (University degree for instance). Nevertheless, over the past ten years, there has been a convergence in cost between university students and *CPGE* students (Figure 6.3, Belghith et al. [2015]), contrary to what is observed in the US with an higher stratification of costs of higher education among universities (Figure 4.2). At a higher level of studies, some authors (Berné and Métivier [2015]) have divided global budget of universities or *grandes écoles* by the number of students, this would be comparable to the average total expenditure of US data. They show that average per student spendings are around 8,300 euros per year in universities and 16,300 euros per year in engineering schools. They also show an heterogeneity in spendings among universities that is important but uncomparable to US heterogeneity in spendings. For instance, some universities have spendings inferior to 6,000 euros per student per year (*Lyon 2, Nimes, Montpellier 3, Rennes 2, Grenoble 2, Toulouse 1, Montpellier 1, Paris 1...*) while others spend more than 13,000 euros per student per year (*Grenoble 1, Montpellier 2, UPMC, Lille 1, Corse, Nouvelle Calédonie, Mulhouse, Paris 11, Paris 7...*). Nevertheless, in France, the heterogeneity in spendings is more due to the dual system created by *grandes écoles*: if average spendings in engineering schools is 16,300 euros, it can be more than 60,000 euros per student per year in some schools like *Polytechnique, Mines* or *ENS*.

¹*CPGE (Classes Préparatoires aux Grandes Écoles)* are 2 or 3 years intensive curriculum settled in High School to prepare competitive exam to go to selective schools

²*STS (Sections de Technicien Supérieur)* are 2 years curriculum settled in High School, they are usually professionally oriented

FIGURE 6.3: Average spendings per level of education in France from 1980 to 2017 (in constant 2017 euros)



Reading: In 1980, average per student spendings in France were 8,300 euros.

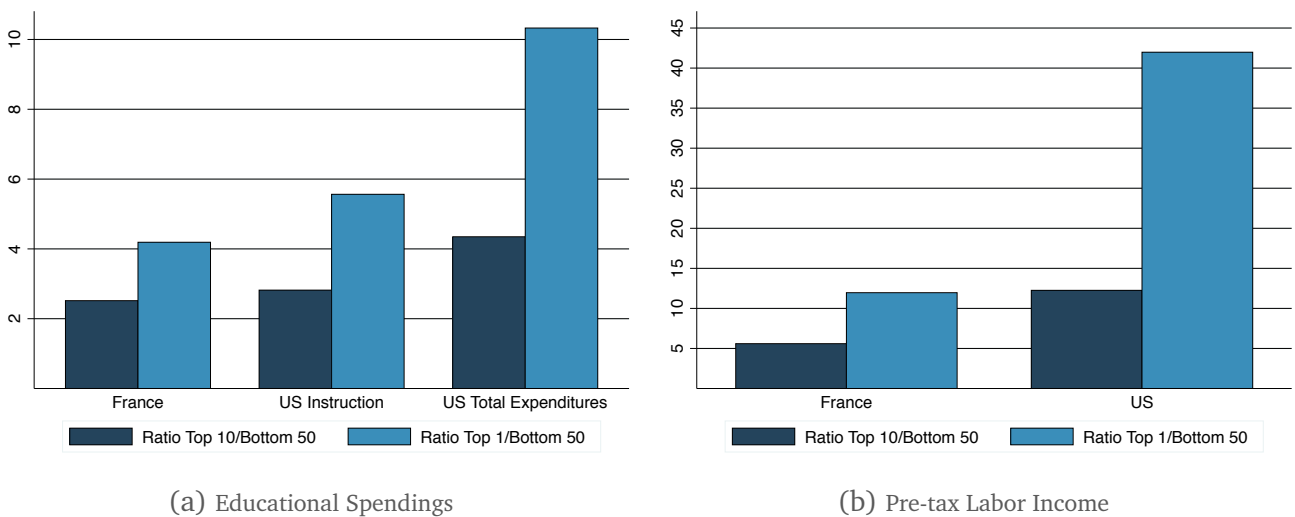
Sources: DEPP

6.1.3 Comparison with wages inequalities

6.1.3.1 Entire educational career

As pre-tax labor income, the distribution of educational spendings is more unequal in the US than in France (Figure 6.4) but the order of magnitude are still totally different. In the US, pre-tax labor income are far more unequally distributed than educational spendings as the top 10 percent has more than 10 times more pre-tax labor income than the bottom 50 and has 3 times more educational spendings with instructional expenditures and 4 times more with average total expenditures. The top 1 percent has more than 40 times more pre-tax labor income than the bottom 50 and has between 6 and 10 times more educational spendings.

FIGURE 6.4: Distribution of educational spendings and pre-tax labor Income in France and in the US in 2001



Reading: In 2001, the Top 1 percent of people having higher pre-tax labor income in the US have more than 40 times more than the Bottom 50; in comparison the Top 1 percent of people having the highest educational spendings have around 6 times more than the Bottom 50 in educational spendings with instructional expenditures for Higher Education and 10 times more with average total expenditure.

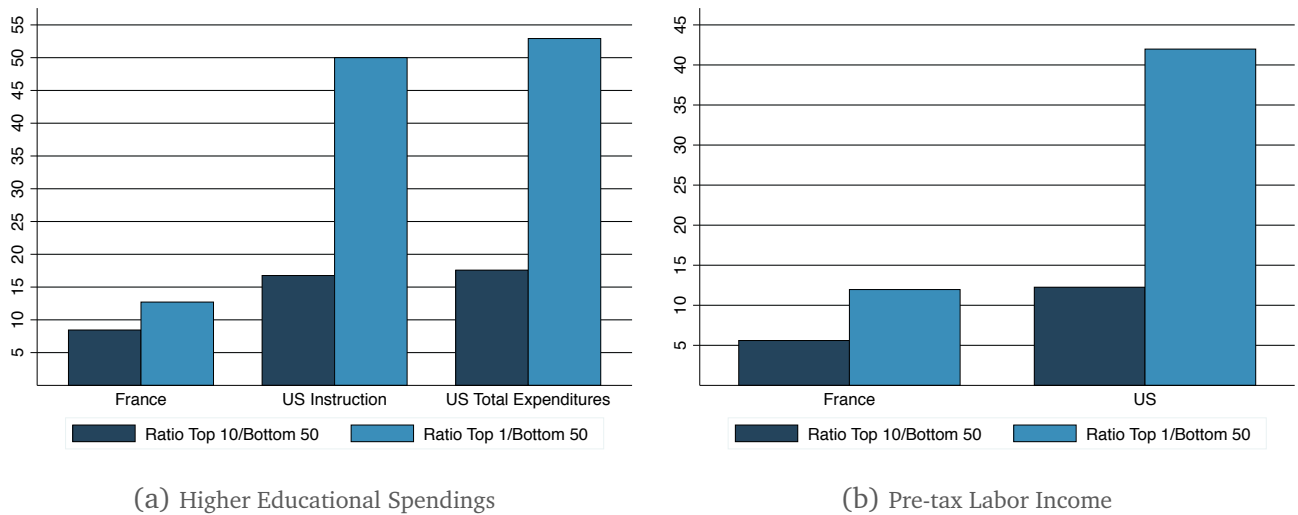
NB: Distribution for educational spendings are an average of results with hypothesis 1 and hypothesis 2 (lower and higher bounds for inequalities)

Sources: Computations based on WID data for pre-tax income, this master thesis data for education in the US and Zuber (2003) for education in France

6.1.3.2 Higher Education

Focusing on higher education only, spendings are far more unequally distributed and closer to pre-tax income. Order of magnitude of the distribution of higher educational spendings and wages are very similar (Figure 6.5), with higher educational spendings being even slightly more unequally distributed than pre-tax labor income. This is consistent with a model where what matters the most in term of returns to education is higher education and where K-12 education is a way to provide some common ground to all the citizens, distributed relatively equally (compared to income).

FIGURE 6.5: Distribution of Higher Education Spendings (for those going to Higher Education) and pre-tax labor Income in France and in the US in 2001

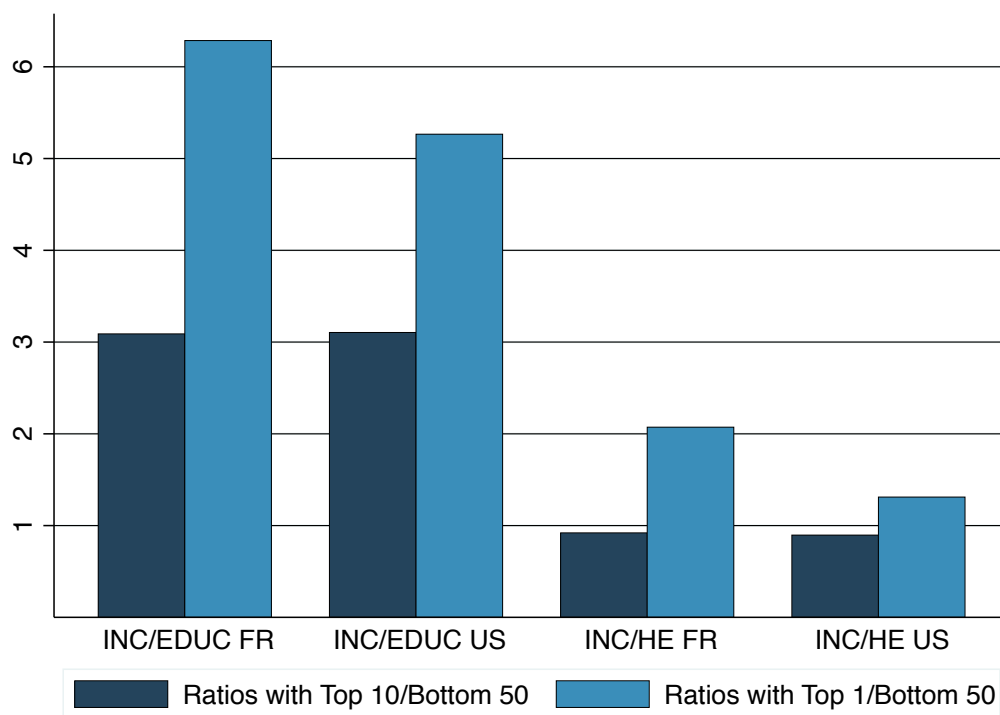


Reading: In 2001, the Top 1 percent of people having higher pre-tax income in the US have more than 40 times more than the Bottom 50; in comparison the Top 1 percent of people having the highest higher educational spendings have 50 times more than the Bottom 50.

Sources: Computations based on WID data for pre-tax income, this master thesis data for the US and Zuber (2003) for France

Computing the ratios of income inequalities over educational spendings inequalities (Figure 6.6), we remark that income inequalities are almost always higher than educational ones. With the entire educational career, income inequalities are between 3 and 6 times bigger than educational ones. With higher educational spendings, they are between 0.9 and 3 times bigger. For the top 1 percent compared to the bottom 50, the level of income inequalities in France compared to educational ones is higher than in the US. For the top 10 percent compared to the bottom 50, levels of income inequalities over educational ones are similar in France and in the US.

FIGURE 6.6: Ratio of income inequalities over educational inequalities in 2001



Reading: In 2001 in France, for the top 1 percent, there are 6 times more income inequalities than educational spendings inequalities.

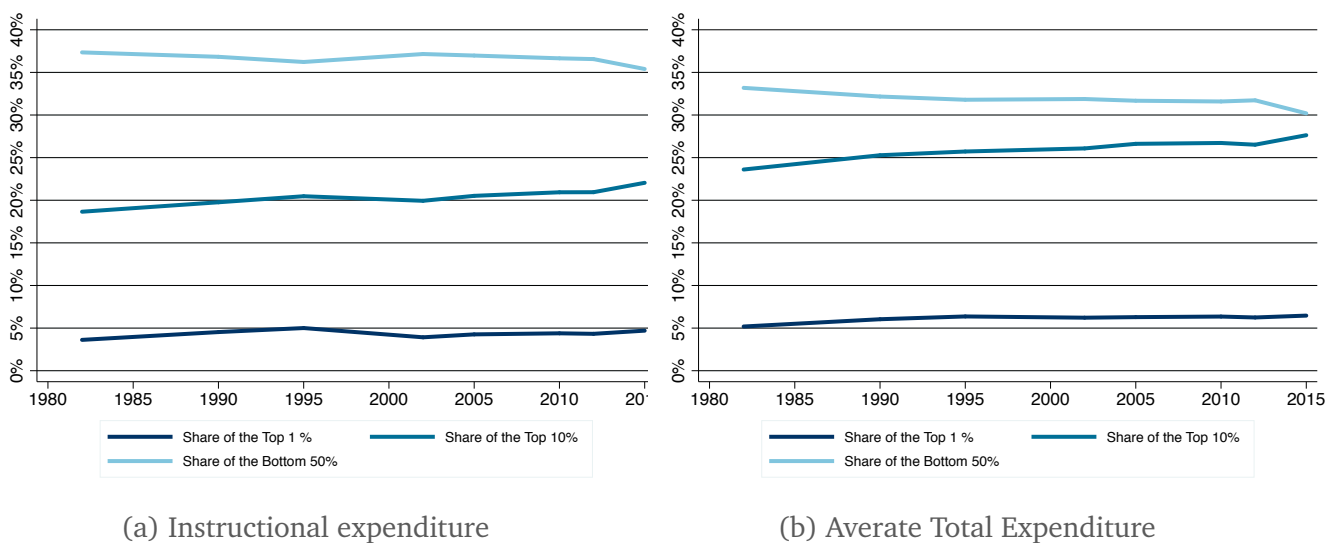
Sources: Computations based on WID data for pre-tax income, this master thesis data for the US and Zuber (2003) for France

6.2 Comparison over time

6.2.1 Entire educational career

From 1980 to 2015, the share of educational spendings dedicated to the bottom 50 percent of individuals for whom the less is spend has decreased a bit from 37% to 35% of the spendings, while the ones of the top 10 and top 1 percent have slightly increased (Figure 6.7).

FIGURE 6.7: Evolution of the shares of the top 1, top 10 and bottom 50 of educational spendings for the cohorts entering first grade between 1970 and 2003

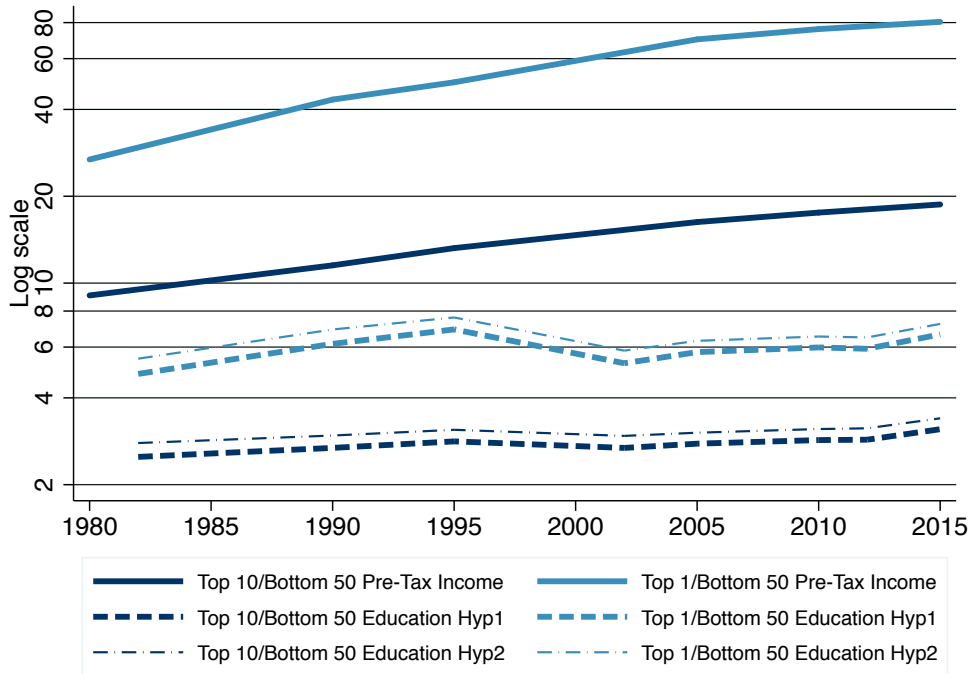


Reading: The Top 1 percent of people having the highest educational spendings in the cohort entering first grade in 1970 have between 4% (instructional expenditure) and 5% (average total expenditure) of the overall spendings.

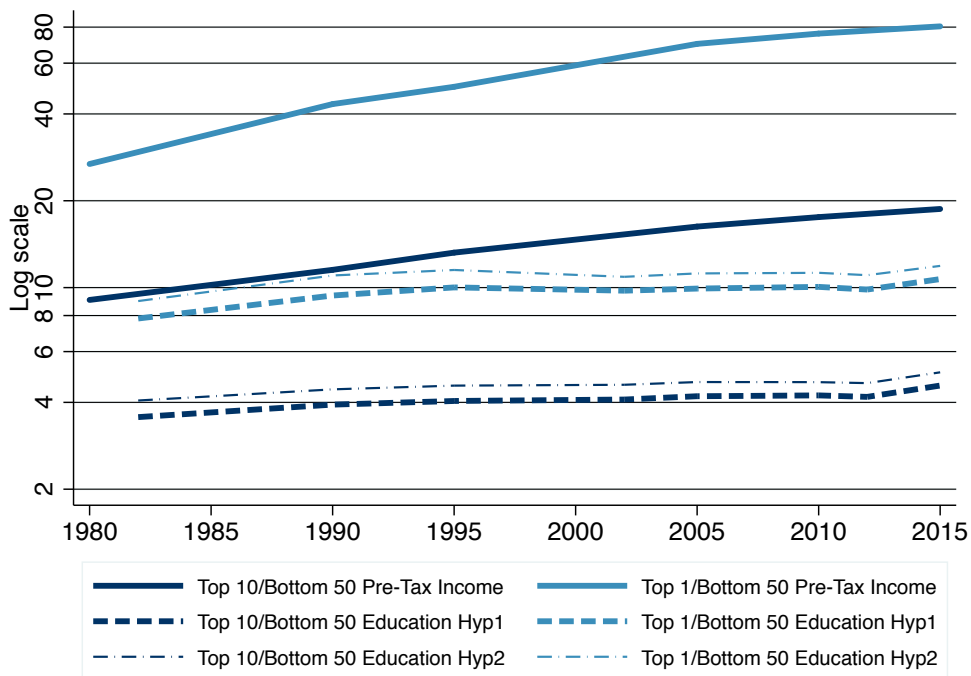
Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

Comparing the evolution of pre-tax income over time with the global distribution of educational spendings for cohorts entering first grade between 1970 and 2003, I observe an increase both in inequalities in educational spendings and in pre-tax income. The concentration of pre-tax income is much higher than the one of educational spendings but evolutions goes in the same direction (Figure 6.8).

FIGURE 6.8: Evolution of the distribution of educational spendings for the cohorts entering first grade between 1970 and 2003 and pre-tax Income in the US



(a) Instructional expenditure



(b) Average Total Expenditure

Reading: In 1980, the Top 1 percent of people having higher pre-tax income in the US have 27 times more than the Bottom 50; in comparison the Top 1 percent of people having the highest educational spendings in the cohort entering first grade in 1970 have between 5 times (instructional expenditure) and 9 times (average total expenditure) more than the Bottom 50.

NB: Hypothesis 1: dropouts are uniformly distributed among deciles of spendings

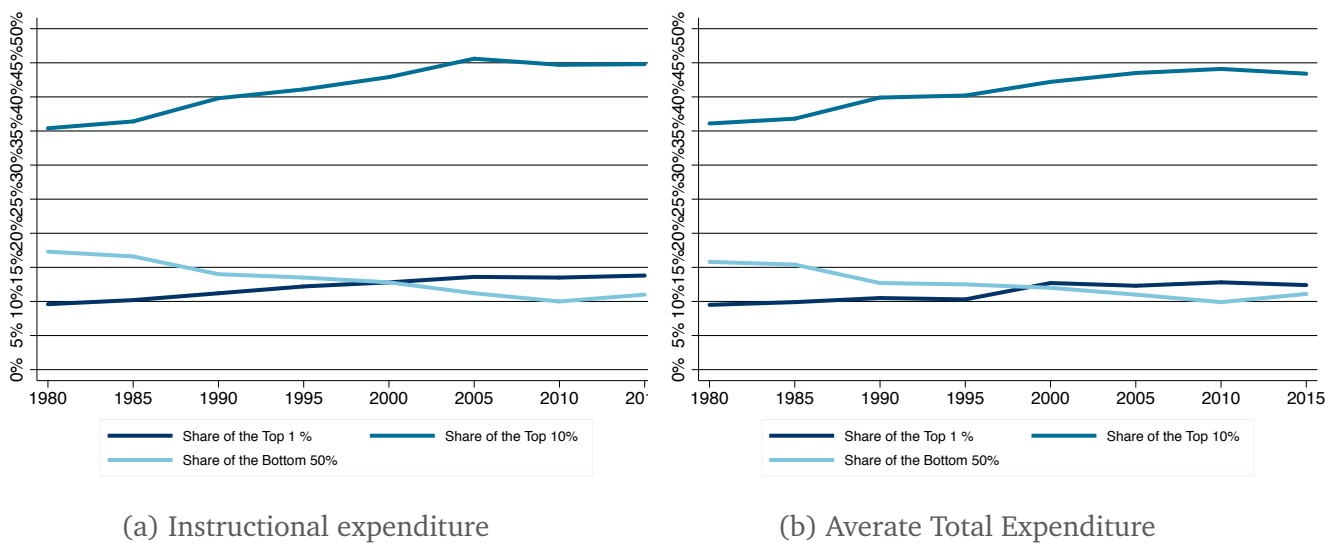
Hypothesis 2: dropouts are concentrated at the lowest spending deciles

Sources: Computations based on WID data for pre-tax income, this master thesis data for educational spendings

6.2.2 Specific role of Higher Education

When we focus on higher education, there is a big increase in spendings inequalities with the share of the top 10 percent of students for whom the most is spent increasing from 35% in 1980 to 45% in 2015, while the one of the bottom 50 decrease from 17% to around 10% (Figure 6.9).

FIGURE 6.9: Evolution of the shares of the top 1, top 10 and bottom 50 of higher educational spendings from 1980 to 2015



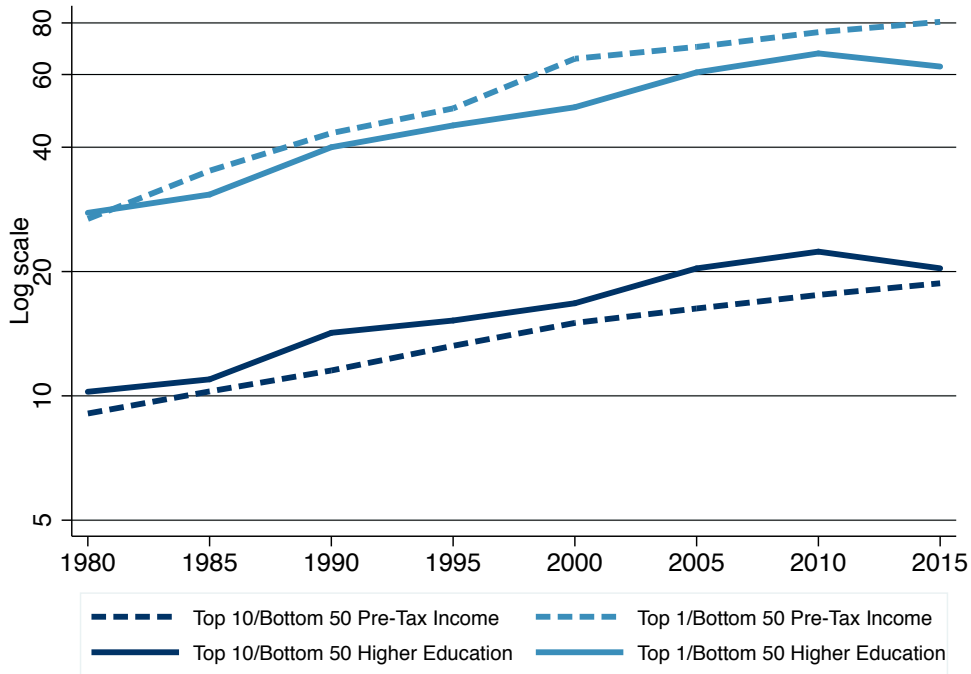
Reading: The Top 1 percent of people having the highest higher educational spendings have around 10% of the overall spendings in 1980 both with instructional expenditures and average total expenditures.

Sources: IPEDS finance and enrollment data

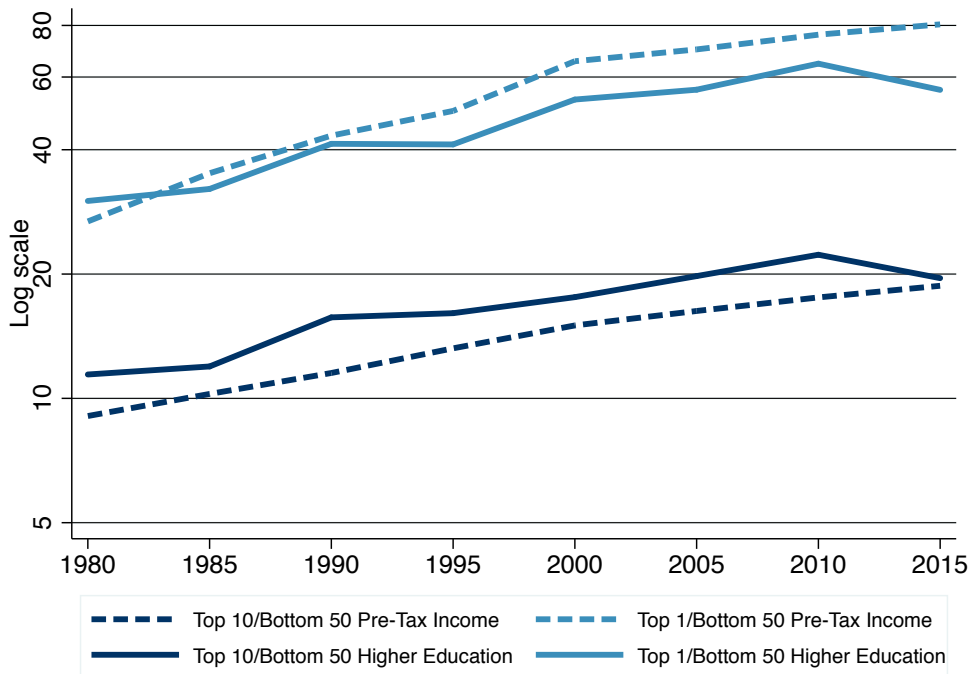
There are far more similarities between distributions of pre-tax income and of instructional expenditures. The ratios of higher educational spendings of the top 1 over the bottom 50 almost completely follows the one of pre-tax income (Figure 6.10) and for the one of the top 10 percent over the bottom 50, educational spendings are even more unequally distributed than pre-tax income.

This evolution is consistent with a model where what matters the most for the evolution of the top 10% share is the higher education that has been invested in them whereas for the top 1%, "human capital isn't totally enough" in a sense and must be coupled with other forms of endowment (economic capital, social capital embedded in social connection for instance, etc.).

FIGURE 6.10: Evolution of the distribution of higher educational spendings and pre-tax income in the US from 1980 to 2015



(a) Instructional expenditure



(b) Average Total Expenditure

Reading: In 1980, the Top 1 percent of people having higher pre-tax income in the US have 27 times more than the Bottom 50.
NB: Higher education spendings are computed based on instructional spendings or average total expenditure for all the Higher Educational career (with the length of studies being the average length of the degree in the institution enrolled).
 There is a lag between educational spendings and income: people actually in college aren't (completely) in the labor market so that the distribution of higher education expenditures should be compared to the one of pre-tax income, 10 years after or latter for instance

Sources: Computations based on WID data for pre-tax income, this master thesis data for higher educational spendings (IPEDS survey)

CHAPTER 7

SOME ELEMENTS OF EXPLANATION

7.1 Decomposition of inequalities

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 spendings per grade. The first inequality can, to some extent, 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 spendings, optimal educational spendings 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 the 1970 if the educational attainment was the one of 2005? And, what would have been the level of inequalities in the 2005 if the educational attainment was the one of 1970?

For this decomposition, I infer the proportion of secondary dropouts of 1970 to the 2005 cohort and the one of 2005 to the 1970 cohort. For college, I compute counterfactual spendings for 1980 with 1980 spendings and 2017 length of studies and for 2017 with 2017 spendings and 1980 length of studies per institution. I then use the same method as in Chapter 5 to combine inequalities in K-12 and higher education : hypothesis 1 assumes that dropouts are uniformly distributed in each percentile and hypothesis 2 assumes that dropout are concentrated at the bottom of the distribution of spendings. I use the proportion of college goers of 2017 for 1980 and of 1980 for 2017

Overall, 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 wouldn't change much in the distribution of spendings (Table 7.1 and Table A11).

Moreover, it is striking to find opposite results that what I would expect. Indeed, I would expect that the level of inequalities in the 1970 with 2005 educational attainment would be lower than the one in the main specification –as there are less dropouts and more people have access to higher education– and the level of inequalities in 2005 with 1970 educational attainment to be higher than the one in the main specification –as there are more dropouts and less people have access to higher education–. Even if the change are tenuous, I find opposite effects: the level of inequalities in 1970 with 2005 educational attainment slightly increase and the level of inequalities in 2005 with 1970 educational attainment slightly decrease.

- With instructional expenditure (Table 7.1)¹, in 1970 with 2005 educational attainment the top

¹Results with Average Total Expenditure for Higher Education are presented in the Appendix A - Table A11

10% would have between 19.3% and 20.2% of spendings (contrary to between 18.6% and 20%) and the bottom 50% would have 34.7% and 36.3 % (contrary to between 35.9% and 37.3%).

- In 2005 with 1970 educational attainment the top 10% would have 21.2% and 23% of spendings (contrary to between 22.3% and 23.6%) and the bottom 50% would have 34.9% and 36.3 % (contrary to between 33.8% and 35%).

This can be explained as the level of inequalities in higher education is way higher than the one in elementary and secondary education: when more people have access to it, the overall level of inequalities is higher. Dropouts doesn't play a big role as they concern a small fraction of the population.

There is so much variance in spendings per grade, that the overall level of educational attainment doesn't seem to play a big role. This is to be confirmed in the next section.

TABLE 7.1: Hypothetical distribution of spendings with instructional spendings for higher education

1970 cohort - 2005 Educational Attainment				
Hypothesis 1			Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$89,612		\$89,612
Top 0.1 %	0.99%	\$452,042	1.06%	\$479,061
Top 0.5 %	2.45%	\$274,741	2.56%	\$286,918
Top 1 %	3.83%	\$224,968	4.01%	\$239,396
Top 10 %	19.3%	\$127,516	20.2%	\$132,597
Bottom 50 %	36.3%	\$81,342	34.7%	\$78,125
Bottom 10 %	5.58%	\$55,631	5.00%	\$55,567

2005 cohort - 1970 Educational Attainment				
Hypothesis 1			Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$147,092		\$147,092
Top 0.1 %	0.87%	\$877,666	1.08%	\$1,037,841
Top 0.5 %	2.79%	\$536,941	3.11%	\$569,108
Top 1 %	4.39%	\$420,415	4.78%	\$445,361
Top 10 %	21.2%	\$218,100	23.0%	\$232,989
Bottom 50 %	36.3%	\$123,156	34.9%	\$121,388
Bottom 10 %	5.82%	\$96,817	4.82%	\$84,899

Reading: If those that entered first grade in 2005 had the educational attainment of the 1970's, the bottom 50 percent of individuals would have spendings between \$121,388 (hypothesis 2) and \$123,156 (hypothesis 1). They would have between 34.9 % and 36.3% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditures only.

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

7.2 Role of length of studies

Applying the level of educational attainment of 2005 to 1970 and reversly doesn't change much in term of the distribution of inequalities. To explore further what is the role of global educational attainment on the distribution of spendings, I study the distribution of spendings if everyone where to attain the bachelor level. The only inequality that remains is through variance of spendings per grade. As expected the two hypotheses give the same results as they change through the distribution of dropouts and here I assume everyone to have the same level of education.

Once again, this is striking to observe that the distribution of spendings doesn't change much. If everyone where to go until bachelor studies with the same distribution of spendings as currently (Table

7.2 and Table A12):

- With instructional expenditure (Table 7.2)², in 1970 the top 10% would have 18.5% of spendings (contrary to between 18.6% and 20%) and the bottom 50% would have 37.3 % (contrary to between 35.9% and 37.3%).
- In 2005 the top 10% would have 21.8% of spendings (contrary to between 22.3% and 23.6%) and the bottom 50% would have 35.5 % (contrary to between 33.8% and 35%).

The decrease in concentration of spendings is slightly more visible at the top of the distribution but still tenuous. Leveraging educational attainment with everyone having access to an undergraduate degree wouldn't decrease a lot inequalities in spendings as long as variance per grade stays the same.

In order to reduce inequalities in educational spendings, giving more people access to higher education until the bachelor level wouldn't change much of the picture, contrary to what we would expect with regard to the experience of European countries for instance. Indeed, in Europe, many policies aiming at reducing educational inequalities try to expand the public of higher education. It doesn't mean that more people having access to the bachelor level isn't a good thing, it probably have many benefits in terms of increase in human capital of the population, broadness of mind, reducing criminality, etc.

The next section will explore what would be the result of an averaging of variance per grade.

²Results with Average Total Expenditure for Higher Education are presented in the Appendix A - Table A12

TABLE 7.2: Hypothetical distribution of spendings with instructional spendings for higher education

1970 cohort - Everyone Bachelor				
Hypothesis 1			Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$98,255		\$98,255
Top 0.1 %	0.92%	\$467,598	0.92%	\$467,598
Top 0.5 %	2.29%	\$283,204	2.29%	\$283,204
Top 1 %	3.59%	\$232,730	3.59%	\$232,730
Top 10 %	18.5%	\$134,475	18.5%	\$134,475
Bottom 50 %	37.3%	\$91,509	37.3%	\$91,509
Bottom 10 %	5.69%	\$62,668	5.69%	\$62,668

2005 cohort - Everyone Bachelor				
Hypothesis 1			Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$172,488		\$172,488
Top 0.1 %	0.88%	\$1,076,570	0.88%	\$1,076,570
Top 0.5 %	2.69%	\$668,817	2.69%	\$668,817
Top 1 %	4.40%	\$489,401	4.40%	\$489,401
Top 10 %	21.8%	\$259,710	21.8%	\$259,710
Bottom 50 %	35.5%	\$144,898	35.5%	\$144,898
Bottom 10 %	5.86%	\$112,119	5.86%	\$112,119

Reading: If those that entered first grade in 2005 would all go until bachelor studies, the bottom 50 percent of individuals would have \$144,898 in spendings. They would have 35.5% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditures only.

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

7.3 Role of variance in spendings per grade

As removing the inequality coming from the length of studies wouldn't change a lot the distribution of spendings, we can wonder what would be this level of inequality if everyone were given the same spendings.

In this section, I study what would be the level of inequalities if the only inequality to remain would be the one of the length of study but if everyone were given the average spending in each of their curriculum (everyone in first grade as the average spending for one year of K-12 education, everyone in bachelor as the average spending for one year of bachelor, etc.)

Here the levels of inequalities are a much smaller reinforcing the idea that the main inequality comes

through variance of spendings per grade (Table 7.3 and Table A13):

- With instructional expenditure (Table 7.3)³, in 1970 the top 10% would have 11.2% of spendings (contrary to between 18.6% and 20%) and the bottom 50 % would have 46.4 % (contrary to between 35.9% and 37.3%)
- With instructional expenditure, in 2005 the top 10% would have 12.1% of spendings (contrary to between 22.3% and 23.6%) and the bottom 50% would have between 46.3% and 46.5% (contrary to between 33.8% and 35%)

Reducing the variance in spendings within each grade –between districts for elementary and secondary education and between institutions for higher education– would be much more efficient to decrease the concentration of educational investments than having everyone completing the same level of education (not taking into account the fact that having everyone completing the same level of education would probably not be efficient on a social planner perspective).

³Results with Average Total Expenditure for Higher Education are presented in the Appendix A - Table A13

TABLE 7.3: Hypothetical distribution of spendings with instructional spendings for higher education

1970 cohort - Everyone mean spendings					
		Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)	
Mean spendings		\$180,511		\$180,511	
Top 0.1 %	0.11%	\$206,283	0.11%	\$206,283	
Top 0.5 %	0.57%	\$205,799	0.57%	\$205,799	
Top 1 %	1.13%	\$205,565	1.14%	\$205,565	
Top 10 %	11.2%	\$196,256	11.2%	\$196,256	
Bottom 50 %	46.4%	\$176,927	46.4%	\$176,927	
Bottom 10 %	7.56%	\$154,076	7.56%	\$154,076	

2005 cohort - Everyone mean spendings					
		Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)	
Mean spendings		\$164,327		\$164,327	
Top 0.1 %	0.13%	\$212,014	0.13%	\$212,014	
Top 0.5 %	0.64%	\$208,459	0.64%	\$208,459	
Top 1 %	1.27%	\$207,612	1.27%	\$207,612	
Top 10 %	12.1%	\$190,005	12.1%	\$190,005	
Bottom 50 %	46.5%	\$155,806	46.5%	\$155,806	
Bottom 10 %	8.59%	\$155,806	8.59%	\$155,806	

Reading: If those that entered first grade in 2005 would all have the same spendings per grade (the only inequalities coming from different length of studies), the bottom 50 percent of individuals would have \$155,806 in spendings. They would have 46.5% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are instructional expenditures only.

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

CONCLUSION

This study aimed at analysing the distribution of educational spendings in the US from 1970 to 2017 and to compare it to the same distribution in France. For K-12 education, despite the several school finance reforms that occurred in the 1970's and 1980's, the level of inequalities in per pupil spending between districts at a national level has stayed remarkably constant with the top 1% of pupils having between 2.5% and 3% of the spendings, the top 10 between 15% and 19% and the bottom 50 around 40% of the spendings. The concentration of these spendings had decreased a little in the 1970's and 1980's (presumably under the influence of school finance reforms) but has increased back in the late 1990's-early 2000's to reach the same level of 1970 nowadays.

In Higher Education, the picture is totally different as instructional spendings and several definitions of expenditures are far more concentrated with the top 1% of students having between 7% and 11% of expenditures, the top 10% having between 28% and 36% and the bottom 50 between 20 and 25%. Contrary to what is observed for K-12 education, the concentration of spendings for higher education have increased a lot over the past four decades, as the most spendings deciles have known the biggest increases in expenditure.

At a global level, as we would expect, the level of inequalities has increased a little, but far less than for higher education alone as higher education only represents between 1 and 6 years of study whereas K-12 education last for 12 years for people that graduate from High-School. Overall, the top 1% of individuals for whom the most is spent for education have around 5% of spendings, the top 10% around 20% and the bottom 50 percent around 35%.

Shares of top 1, top 10 and bottom 50 for different levels of education from 1970 to 2017

	1970 cohort			2005 cohort		
	Bottom 50	Top 10	Top 1	Bottom 50	Top 10	Top 1
Elementary Cross-sectional	37.0%	18.5%	3.65%	38.3%	18.7%	2.76%
Elementary Longitudinal	40.5%	15.8%	2.86%	40.9%	16.8%	2.68%
College Cross-sectional	25.5%	27.7%	6.94%	20.3%	36.3%	10.6%
College Longitudinal	17.5%	35.1%	9.9%	10.9%	44.9%	14.5%
Global (Instruction)	36.7%	19.3%	3.8%	34.4%	22.9%	4.9%
Global (Average expenditure)	32.3%	24.6%	5.40%	30.0%	28.9%	6.80%

Sample:1970- 1981 School Districts and 1980 colleges for 1970 cohort; 2005-2017 School Districts and 2017 colleges for 2005 cohort

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

What is striking when we decompose inequalities into a part coming from the length of studies and a part coming from variance in spending within each level of education is that length of studies doesn't play much to change the distribution of educational spendings. Only a reduction of the variance of spendings per grade could significantly reduce the concentration of educational spendings observed, whose level for higher education gets close to the ones observe for wages.

This study is limited in its evaluation of inequalities as it affects the same spendings to all schools in a district and to all the students of a particular university. This would be interesting to study within-district inequalities and inequalities between different curriculum of a university. Zuber [2003] showed that in France, there is a big heterogeneity in spendings within a university depending on the curriculum people are registered to. As IPEDS study only presents global expenditure figures, not separating among different subjects (unless for tuition fees), I leave that for future research.

This study aimed at describing the distribution of educational spendings at the global level and their evolution over time. Even if causal analysis based on event 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 shouldn't be a reason to forget about the global picture of what is happening in term of educational spendings.

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APPENDIX A: DIFFERENT DEFINITION OF EDUCATIONAL SPENDINGS

Elementary Education

Evolution of inequalities with alternative definition of spendings

To measure if the stability of spendings inequalities holds with an alternative definition of spendings, I compute the distribution of spendings from 1990 to 2016 with instructional spendings (and not global educational ones). I can't go back in time as data from Historical Finances of Individual Governments (IndFin) used from 1967-1985 doesn't present spendings for instruction separately.

Results in term of distribution are really close to those of table 4.1 showing that the distribution of spendings for instruction is fairly similar to the one of total per pupil spendings: the stability in the distribution of spendings is not linked to spendings for buildings or extracurricular activities for instance.

TABLE A1: Evolution of cost and distribution of per pupil expenditure from 1967 to 2016 in constant 2017 dollars (cross-sectional analysis)

	1967	1970	1975	1980	1985	1990
Total number of students in the data	28,604,772	28,548,784	30,438,324	35,653,084	32,669,830	40,432,080
Total number of districts in the data	5,837	5,869	5,673	14,430	12,016	15,138
Mean of per student spending	\$4,841	\$5,708	\$6,198	\$6,782	\$7,483	\$5,050
Top 0.1% of students	\$19,187	\$21,766	\$19,043	\$18,788	\$20,715	\$14,999
Percentage of the overall spending	0.95%	1.07%	0.70%	0.46%	0.41%	0.34%
Top 0.5% of students	\$12,144	\$15,975	\$15,531	\$14,622	\$16,800	\$12,093
Percentage of the overall spending	2.16%	2.31%	1.75%	1.38%	1.37%	1.38%
Top 1% of students	\$10,327	\$13,842	\$12,989	\$13,103	\$15,187	\$10,671
Percentage of the overall spending	3.28%	3.65%	2.90%	2.43%	2.45%	2.51%
Top 10% of students	\$6,584	\$7,954	\$8,418	\$8,913	\$9,971	\$7,037
Percentage of the overall spending	17.5%	18.5%	17.0%	15.8%	16.1%	16.6%
Bottom 50% of students	\$4,540	\$5,367	\$5,864	\$6,556	\$7,187	\$4,685
Percentage of the overall spending	38.7%	37.0%	39.5%	40.0%	39.7%	39.2%
Bottom 10% of students	\$3,242	\$3,586	\$4,249	\$4,744	\$5,217	\$3,500
Percentage of the overall spending	5.86%	5.44%	6.03%	6.19%	5.78%	6.19%
	1995	2000	2005	2010	2016	Evolution (from 1990)
Total number of students	43,807,624	46,432,784	48,055,256	48,266,208	48,514,348	+ 20%
Total number of institutions in the data	14,454	14,378	14,105	13,515	13,471	-11%
Mean of per student spending for instruction	\$5,417	\$6,030	\$6,660	\$7,139	\$7,246	+ 43.4%
Top 0.1% of students	\$14,874	\$24,785	\$22,367	\$22,291	\$22,403	+ 49.4%
Percentage of the overall spending	0.33%	0.52%	0.48%	0.48%	0.43%	
Top 0.5% of students	\$12,321	\$13,007	\$15,170	\$22,291	\$22,403	+ 85.2%
Percentage of the overall spending	1.30%	1.51%	1.50%	0.48%	0.43%	
Top 1% of students	\$11,103	\$11,690	\$13,513	\$17,281	\$19,122	+ 79.20%
Percentage of the overall spending	2.36%	2.51%	2.56%	1.51%	0.99%	
Top 10% of students	\$7,830	\$8,236	\$9,182	\$10,055	\$10,590	+ 49.2%
Percentage of the overall spending	16.3%	16.2%	17.1%	18.0%	18.7%	
Bottom 50% of students	\$4,917	\$5,542	\$6,023	\$6,279	\$6,289	+ 34.2%
Percentage of the overall spending	39.7%	40.8%	40.1%	39.0%	37.7%	
Bottom 10% of students	\$3,950	\$4,555	\$4,994	\$5,222	\$5,107	+ 45.9%
Percentage of the overall spending	6.80%	7.07%	7.32%	6.67%	6.30%	

Reading: In 2016, the top 10% of student for whom the most is spent in instructional spendings have spendings above \$10,590 per year, they have 19.9% of the overall spendings.

Sample: 1967-2016 school districts

N.B: Spendings are total per pupil spendings from 1967 to 1985 and spendings for instruction only from 1990 to 2016

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1985 and Public Elementary-Secondary Education Finance Data for 1990-2016, US Census Bureau*

Definition of Higher Educational Spendings (IPEDS definition)

Instructional spendings

I compute instructional spendings per student based on total instructional expenditures divided by fall enrollment.

Instruction: A functional expense category that includes expenses of the colleges, schools, departments, and other instructional divisions and expenses for departmental research and public service that are not separately budgeted. Includes general academic instruction, occupational and vocational instruction, community education, preparatory and adult basic education, and regular, special, and extension sessions. Also includes expenses for both credit and non-credit activities. Excludes expenses for academic administration where the primary function is administration (e.g., academic deans).

Student oriented resources (without grants and scholarships)

I compute per student spendings without grant adding instructional, academic support, institutional support, student services and public service spendings divided by fall enrollment. I do not include grants spendings in this category.

Academic support: A functional expense category that includes expenses of activities and services that support the institution's primary missions of instruction, research, and public service. It includes the retention, preservation, and display of educational materials (for example, libraries, museums, and galleries); organized activities that provide support services to the academic functions of the institution (such as a demonstration school associated with a college of education or veterinary and dental clinics if their primary purpose is to support the instructional program); media such as audiovisual services; academic administration (including academic deans but not department chairpersons); and formally organized and separately budgeted academic personnel development and course and curriculum development expenses. Institutions include actual or allocated costs for operation and maintenance of plant, interest, and depreciation.

Institutional support: A functional expense category that includes expenses for the day-to-day operational support of the institution. Includes expenses for general administrative services, central executive-level activities concerned with management and long range planning, legal and fiscal operations, space management, employee personnel and records, logistical services such as purchasing and printing, and public relations and development. Also includes information technology expenses related to institutional support activities.

onregistrar activities, and activities whose primary purpose is to contribute to students emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program. Examples include student activities, cultural events, student newspapers, intramural athletics, student organizations, supplemental instruction outside the normal administration, and student records. Intercollegiate athletics and student health services may also be included except when operated as self-supporting auxiliary enterprises. Also may include information technology expenses related to student service activities if the institution separately budgets and expenses information technology resources (otherwise these expenses are included in institutional support.)

Public service : A functional expense category that includes expenses for activities established primarily to provide noninstructional services beneficial to individuals and groups external to the insti-

tution. Examples are conferences, institutes, general advisory service, reference bureaus, and similar services provided to particular sectors of the community. This function includes expenses for community services, cooperative extension services, and public broadcasting services. Also includes information technology expenses related to the public service activities if the institution separately budgets and expenses information technology resources (otherwise these expenses are included in academic support).

Student oriented resources (with grants and scholarships)

I compute per student spendings without grant adding instructional, academic support, institutional support, student services and public service spendings divided by fall enrollment. I also include grants spendings in this category.

Institutional grants: Scholarships and fellowships granted and funded by the institution and/or individual departments within the institution, (i.e., instruction, research, public service) that may contribute indirectly to the enhancement of these programs. Includes scholarships targeted to certain individuals (e.g., based on state of residence, major field of study, athletic team participation) for which the institution designates the recipient.

Federal grants (grants/educational assistance funds): Grants provided by federal agencies such as the U.S. Department of Education, including Title IV Pell Grants and Supplemental Educational Opportunity Grants (SEOG). Also includes need-based and merit-based educational assistance funds and training vouchers provided from other federal agencies and/or federally sponsored educational benefits programs. (Used for reporting on the Student Financial Aid component)

Grants by state government (student aid): Grant monies provided by the state such as Leveraging Educational Assistance Partnerships (LEAP) (formerly SSIG's); merit scholarships provided by the state; and tuition and fee waivers for which the institution was reimbursed by a state agency. (Used for reporting Finance data)

Grants by local government (student aid): Local government grants include scholarships or gift-aid awarded directly to the student. (Used for reporting Finance data)

Per student average total expenditure

I compute per student average total expenditure dividing global expenditure (for education, research, maintenance of plants, etc.) by fall enrollment. I do not take into account hospital expenditure and independent operation expenditure and I only include half of research expenditure. Even if this category doesn't totally separate research and educational component of universities, it has some interest if students also benefit partly from research activities carried on at their institutions.

Per student average public total expenditure

This category include expenditures per student based on the share of public revenue (local, state and federal government) in global expenses. It doesn't include tuition revenue appart from grants and scholarship received by public institutions. This category is unfortunately not very stable over time.

TABLE A2: Number of higher education institutions over time and average spendings in 2017 dollars

	Instruction per student	Public per student	Public with grants	Average Tuition	Average Total Expenditure	Public Expenditure	Public for Instruction
Number of institutions - 1980	2,619	2,620	2,603	2,620	2,346	2,345	2,345
Average values	\$1,623	\$3,035	\$3,315	\$1,434	\$5,497	\$2,049	\$690
Number of institutions - 1985	2,765	2,769	2,770	2,758	2,771	2,647	2,641
Average values	\$2,474	\$4,793	\$5,785	\$2,435	\$8,853	\$2,947	\$927
Number of institutions - 1990	2,991	2,995	2,995	2,983	2,995	2,806	2,805
Average values	\$4,896	\$9,503	\$11,882	\$5,668	\$17,102	\$5,531	\$1,980
Number of institutions - 1995	3,039	3,043	3,043	3,031	3,043	2,838	2,839
Average values	\$4,018	\$8,067	\$10,142	\$5,033	\$14,964	\$4,436	\$1,410
Number of institutions - 2000	4,569	4,577	4,591	4,591	4,630	4,121	4,087
Average values	\$10,622	\$19,114	\$20,941	\$6,746	\$40,365	\$13,681	\$6,766
Number of institutions - 2005	5,044	5,054	5,055	5,035	5,056	4,052	4,042
Average values	\$7,997	\$15,303	\$17,214	\$7,323	\$26,129	\$9,805	\$3,317
Number of institutions - 2010	5,756	5,765	5,765	5,740	5,764	4,444	4,443
Average values	\$6,344	\$13,660	\$16,260	\$8,901	\$19,120	\$7,112	\$2,468
Number of institutions - 2015	5,756	5,765	5,765	5,740	5,764	4,444	4,443
Average values	\$8,044	\$17,978	\$21,398	\$11,658	\$25,604	\$9,030	\$2,863
Number of institutions - 2017	6,411	6,417	6,417	6,396	6,418	4,928	4,925
Average values	\$8,814	\$20,001	\$23,437	\$13,592	\$28,213	\$8,831	\$2,802

Reading: In 2017, there are 6,411 higher education reporting positive instruction spendings.

In 2017, average instruction per student spendings are \$8,814.

Sample: 1980-2017 colleges and universities

N.B.: Average spendings are in constant 2017 dollars.

Sources: *IPEDS, Finance and Enrollment data*

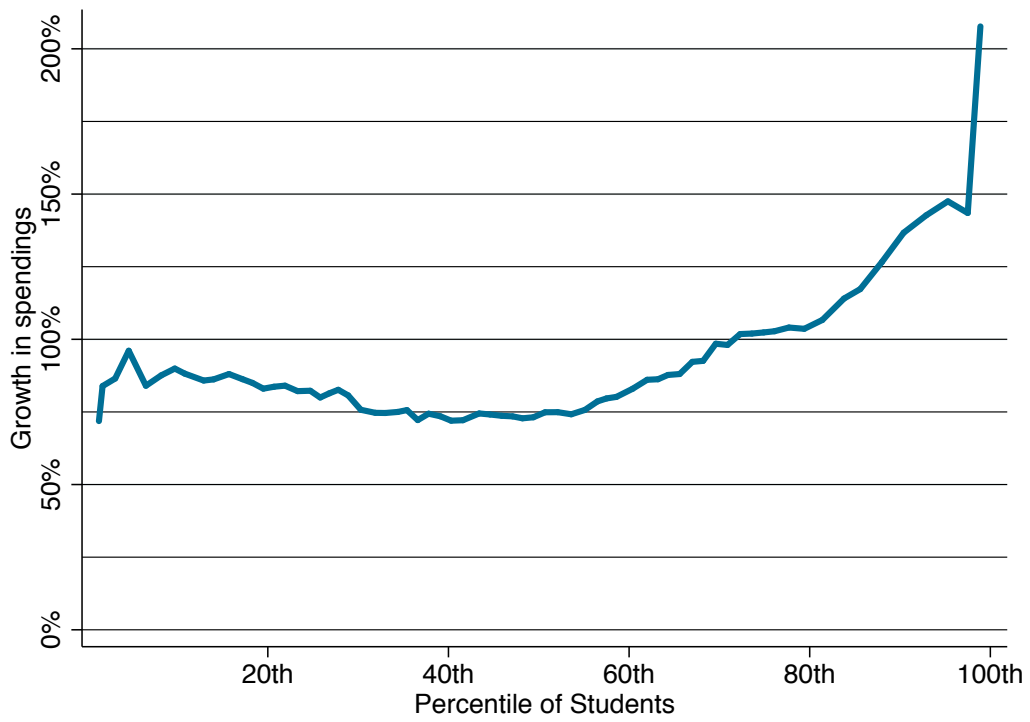
Higher Education Distribution of Spendings with alternative definition of higher educational spendings

To study if the increase in inequalities observed at the higher educational level (cf Table 5.1 and 5.2) is linked to a particular definition of spendings, I compute the evolution of the distribution of spendings with alternative definitions of spendings presented in the last section.

Student oriented resources (without grants and scholarships)

The evolution of spendings oriented to student resources (instructional spendings, academic and institutional support, student services and public services) has known the same evolution as the one of instructional spendings only. It has increased more for the higher deciles of spendings for the top 1% of students than for the median students (+190%). The distribution is slightly more equal with in 2017, 8.3% of the spendings for the top 1% (compared to 10.6%) and almost 34.5% for the top 10% (compared to the 36.2%) showing that ancillary expenses tends to mitigate slightly inequalities in instructional spendings. Over the period, these spendings have increase more than instructional spendings showing that higher education institutions dedicate a higher share of resources to auxiliary expenses over time.

FIGURE A1: Growth incidence curve of per student spendings (without grants and scholarships) between 1980-2017



Reading: Between 1980 and 2017, per student average tuitions for those at the 80th percentile of the distribution of spendings increased around 100%.

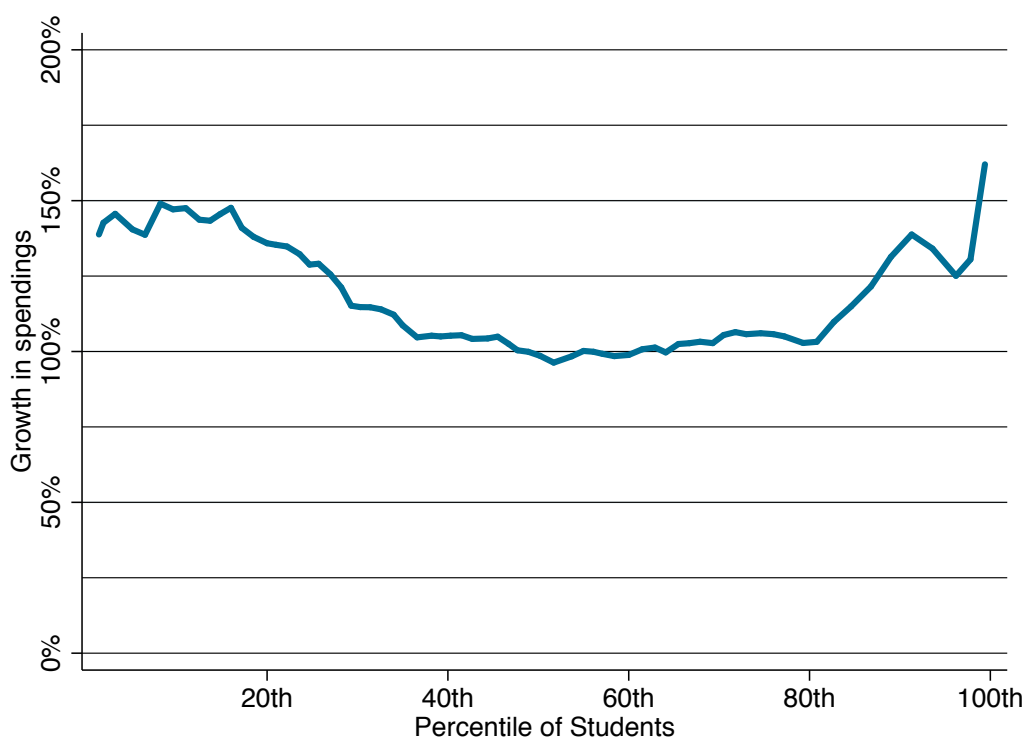
Sample: 1980 and 2017 colleges

Sources: IPEDS 1980 and 2017

Student oriented resources (with grants and scholarships)

Focusing on the distribution of student oriented resources with grants and scholarships included, the increase is more evenly distributed among all the deciles of spendings (+148% for the bottom 10 and +133% for the top 10). The level of inequalities in spendings are slightly lower showing that grants and scholarships are effective at mitigating some of the inequalities in spendings.

FIGURE A2: Growth incidence curve of per student spendings (with grants and scholarships) between 1980-2017



Reading: Between 1980 and 2017, per student average tuitions for those at the 80th percentile of the distribution of spendings increased around 100%.

Sample: 1980 and 2017 colleges

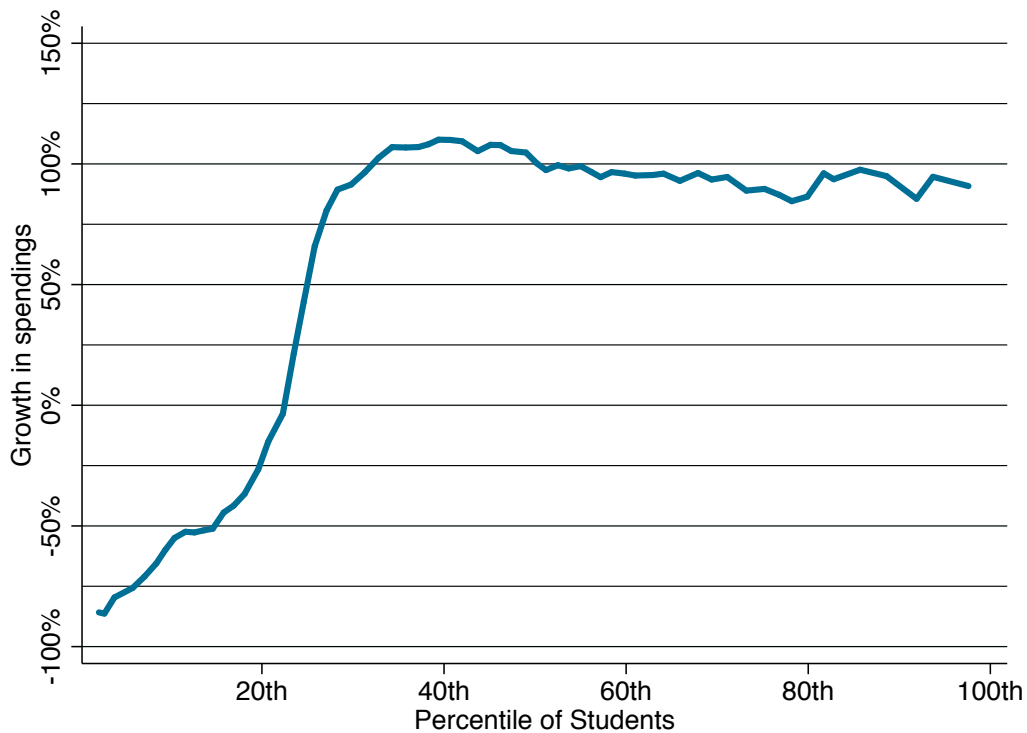
Sources: IPEDS 1980 and 2017

Per student public total expenditure

Focusing on average public expenditure, we observe that levels of inequalities are of the same order of magnitude than instructional expenditure showing that the distribution of spendings coming from public sources is similar to the one focusing on instruction (coming from tuitions, public sources and donations). Nevertheless, I observe that the increase over the period is smaller than for total average expenditure showing that institutions rely more and more to external sources of fundings. I also observe a decrease in public funding for the lowest decile of spendings. This category is less reliable as the definition of what is public is less constant over time than the definition of instructional expenditure for

instance. Institutions between the top 10% and the median of spendings are the one getting the bigger increase in public spendings with more than 100% of increase in these fundings.

FIGURE A3: Growth incidence curve of average public expenditure between 1980-2017



Reading: Between 1980 and 2017, per student average tuitions for those at the 80th percentile of the distribution of spendings increased around 100%.

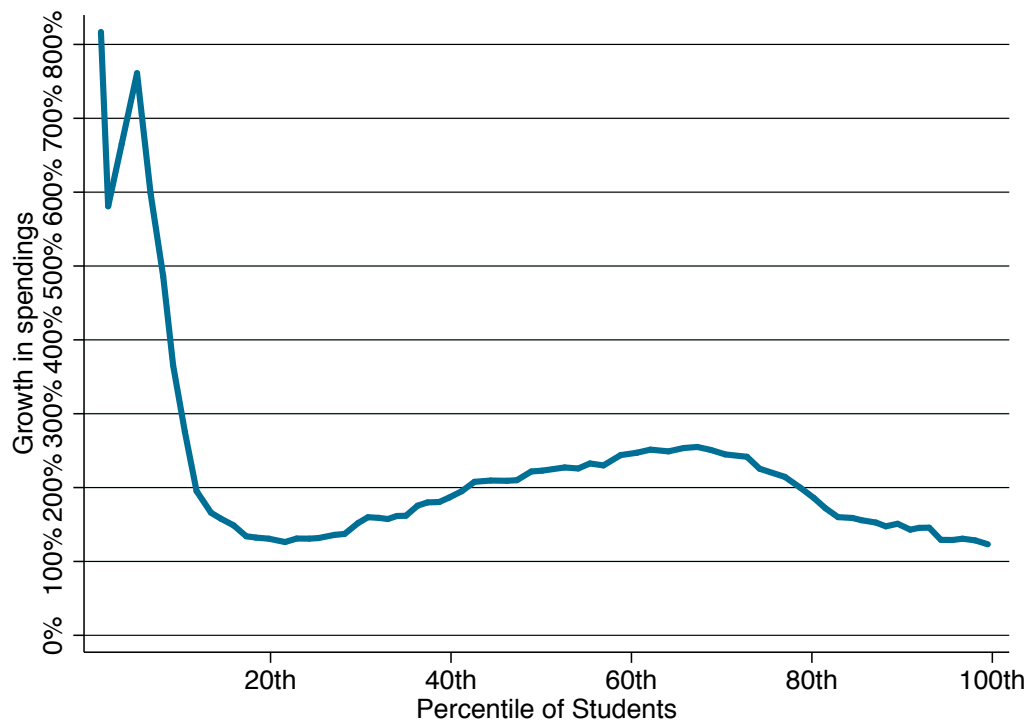
Sample: 1980 and 2017 colleges

Sources: IPEDS 1980 and 2017

Average tuition revenue

Focusing on average tuition revenue, the picture is totally different: the increase in average tuition revenue is higher at the bottom than at the top of the distribution showing that institutions that used to rely less on revenue from tuitions have increased them the most, maybe to compensate for the decrease in public revenue. The distribution of revenue from tuitions is both less concentrated at the top (with smaller share than for instructional spendings for instance) and more unequal at the bottom (with smaller share for the bottom 10 and bottom 50% of students also).

FIGURE A4: Growth incidence curve of average tuition spendings between 1980-2017



Reading: Between 1980 and 2017, per student average tuitions for those at the 80th percentile of the distribution of spendings increased around 200%.

Sample: 1980 and 2017 colleges

Sources: IPEDS 1980 and 2017

TABLE A3: Evolution of cost and distribution of student oriented resources (without grants) from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$8271	\$9524	\$13731	\$11386	\$13382
Top 0.1% of students	\$96,812	\$126,750	\$194,670	\$172,807	\$195,118
Percentage of the overall spending	1.27%	1.74%	2.60%	1.92%	2.37%
Top 0.5% of students	\$42275	\$48,154	\$84,557	\$71,688	\$91,067
Percentage of the overall spending	4.58%	4.96%	5.58%	5.25%	5.91%
Top 1% of students	\$35864	\$42,536	\$70,686	\$58,039	\$66,565
Percentage of the overall spending	6.78%	6.71%	8.63%	7.92%	8.66%
Top 10% of students	\$13856	\$16,472	\$23,891	\$20,314	\$23,325
Percentage of the overall spending	28.44%	28.76%	31.28%	30.90%	33.20%
Bottom 50% of students	\$6,695	\$7,472	\$10,275	\$8,585	\$9,699
Percentage of the overall spending	25.23%	24.72%	24.06%	23.79%	22.79%
Bottom 10% of students	\$2921	\$3300	\$4628	\$3891	\$4272
Percentage of the overall spending	2.95%	2.85%	2.85%	2.95%	2.69%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+ 76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+ 145%
Mean of per student spending	\$13,758	\$14,786	\$16,928	\$17,413	+ 110%
Top 0.1% of students	\$190,118	\$201,201	\$218,297	\$198,032	+ 104%
Percentage of the overall spending	2.30%	1.32%	1.40%	1.67%	
Top 0.5% of students	\$100547	\$109,292	\$125,243	\$140,470	+ 232%
Percentage of the overall spending	5.71%	5.24%	5.51%	5.53%	
Top 1% of students	\$85,269	\$93,478	\$108,245	\$104,021	+ 190%
Percentage of the overall spending	9.25%	8.72%	8.26%	8.34%	
Top 10% of students	\$24,554	\$28,004	\$30,643	\$33,299	+ 140%
Percentage of the overall spending	34.86%	34.43%	34.31%	34.47%	
Bottom 50% of students	\$9,388	\$10,294	\$11,464	\$11,744	+ 75.4%
Percentage of the overall spending	21.26%	21.17%	21.71%	21.45%	
Bottom 10% of students	\$4,214	\$4,507	\$5,381	\$5,498	+ 88.2%
Percentage of the overall spending	2.60%	2.51%	2.67%	2.66%	

Reading: In 2017, the top 10% of student for whom the most is spent have per student spendings above \$33,299, they have 34.47% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS, Finance and Enrollment Data

TABLE A4: Evolution of cost and distribution of student oriented resources (with grants and scholarships) from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$8852	\$11080	\$16734	\$13876	\$15249
Top 0.1% of students	\$102,404	\$127,166	\$208,093	\$177,623	\$198,536
Percentage of the overall spending	1.20%	1.52%	2.15%	1.79%	2.27%
Top 0.5% of students	\$50,198	\$53,119	\$89,435	\$78,634	\$91,229
Percentage of the overall spending	4.28%	4.46%	5.09%	4.65%	5.44%
Top 1% of students	\$38,509	\$48,489	\$79,015	\$64,966	\$71,831
Percentage of the overall spending	6.98%	6.46%	7.48%	6.73%	7.73%
Top 10% of students	\$14,866	\$18,807	\$28,667	\$23,723	\$25,628
Percentage of the overall spending	28.81%	27.90%	30.06%	29.79%	30.61%
Bottom 50% of students	\$7,221	\$9,200	\$12,828	\$10,758	\$11,869
Percentage of the overall spending	24.65%	25.31%	24.79%	24.68%	24.75%
Bottom 10% of students	\$2,946	\$3,647	\$5,715	\$4,784	\$5,346
Percentage of the overall spending	2.82%	2.76%	2.79%	2.94%	2.84%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+ 76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+ 145%
Mean of per student spending	\$15357	\$17082	\$19309	\$19559	120%
Top 0.1% of students	\$192,977	\$201,515	\$226,221	\$205,913	+ 101%
Percentage of the overall spending	2.019%	1.159%	1.220%	1.490%	
Top 0.5% of students	\$100,667	\$109,579	\$126,964	\$140,714	+ 180%
Percentage of the overall spending	5.230%	4.829%	4.900%	5.039%	
Top 1% of students	\$87,676	\$95,670	\$108,406	\$104,596	+ 171%
Percentage of the overall spending	8.619%	7.670%	7.539%	7.690%	
Top 10% of students	\$26,007	\$29,947	\$33,139	\$34,761	+ 133%
Percentage of the overall spending	32.31%	31%	31.15%	31.76%	
Bottom 50% of students	\$11,127	\$12,895	\$14,269	\$14,350	+ 98.7%
Percentage of the overall spending	23.93%	25.04%	25.37%	24.55%	
Bottom 10% of students	\$5,415	\$6,443	\$7,696	\$7,313	+ 148%
Percentage of the overall spending	2.960%	3.059%	3.279%	3.130%	

Reading: In 2017, the top 10% of student for whom the most is spent have per student spendings above \$34,761 , they have 31.76% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS, Finance and Enrollment Data

TABLE A5: Evolution of cost and distribution of average public expenditure per student from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student spending	\$7,164	\$7,789	\$10,455	\$8,671	\$8,982
Top 0.1% of students	\$128,610	\$150,887	\$163,330	\$130,586	\$156,452
Percentage of the overall spending	1.93%	2.34%	2.64%	2.26%	2.83%
Top 0.5% of students	\$53,158	\$51,274	\$59,634	\$50,573	\$51,154
Percentage of the overall spending	6.63%	6.80%	6.29%	6.20%	7.24%
Top 1% of students	\$37,703	\$40,518	\$42,825	\$40,482	\$38,778
Percentage of the overall spending	9.79%	9.80%	9.05%	8.34%	9.13%
Top 10% of students	\$13,595	\$14,846	\$21,553	\$17,627	\$18,255
Percentage of the overall spending	34.63%	34.08%	33.66%	33.45%	34.70%
Bottom 50% of students	\$4,904	\$5,438	\$7,485	\$5,977	\$6,368
Percentage of the overall spending	18.53%	18.80%	21.04%	20.60%	19.23%
Bottom 10% of students	\$1,132	\$1,283	\$2,694	\$2,086	\$1,231
Percentage of the overall spending	0.80%	0.95%	1.53%	1.38%	0.70%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+ 76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+ 145%
Mean of per student spending	\$12,888	\$12,525	\$13,131	\$13,367	+ 86.5%
Top 0.1% of students	\$236,596	\$196,358	\$196,601	\$210,990	+ 64.0%
Percentage of the overall spending	2.62%	2.67%	2.35%	2.17%	
Top 0.5% of students	\$70,411	\$82,733	\$84,024	\$82,338	+ 54.8%
Percentage of the overall spending	6.72%	6.52%	6.11%	7.26%	
Top 1% of students	\$58,688	\$55,509	\$54,513	\$57,009	+ 51.2%
Percentage of the overall spending	9.16%	9.30%	8.93%	9.26%	
Top 10% of students	\$28,589	\$26,911	\$27,719	\$27,906	+ 105%
Percentage of the overall spending	36.27%	36.72%	35.13%	35.06%	
Bottom 50% of students	\$8,570	\$8,364	\$9,607	\$9,886	+ 101%
Percentage of the overall spending	17.52%	16.67%	16.38%	16.23%	
Bottom 10% of students	\$1,047	\$892	\$552	\$503	-55%
Percentage of the overall spending	0.40%	0.30%	0.15%	0.13%	

Reading: In 2017, the top 10% of student for whom the most is spent in public spendings (federal, state and local) have spendings above \$27,906, they have 35.06% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

N.B.: Average public spendings represent the share of total spendings coming from public sources and as such, also include spendings for research and not only educational expenditures

Sources: IPEDS, Finance and Enrollment Data

TABLE A6: Evolution of cost and distribution of average revenue from tuition from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	11,409,336	11,677,120	13,145,883	13,474,887	14,542,413
Total number of institutions in the data	2,619	2,765	2,866	3,034	4,565
Mean of per student revenue from tuition	\$3,117	\$4,008	\$7,153	\$5,935	\$6,003
Top 0.1% of students	\$20,229	\$26,630	\$43,513	\$33,814	\$36,483
Percentage of the overall revenue from tuition	0.44%	0.53%	0.67%	0.67%	1.16%
Top 0.5% of students	\$16,555	\$21,955	\$37,740	\$30,646	\$27,226
Percentage of the overall revenue from tuition	2.91%	3.08%	2.55%	2.79%	3.01%
Top 1% of students	\$15,536	\$20,145	\$35,696	\$28,325	\$25,867
Percentage of the overall revenue from tuition	5.36%	5.38%	5.47%	5.23%	5.28%
Top 10% of students	\$8,220	\$10,127	\$18,405	\$15,403	\$14,102
Percentage of the overall revenue from tuition	37.41%	37.88%	38.27%	37.34%	33.5%
Bottom 50% of students	\$1,851	\$2,442	\$4,166	\$3,523	\$4,135
Percentage of the overall revenue from tuition	14.10%	14.84%	15.31%	15.21%	16.73%
Bottom 10% of students	\$242	\$426	\$1,087	\$908	\$1,047
Percentage of the overall revenue from tuition	0.29%	0.70%	0.88%	0.92%	0.89%
	2005	2010	2015	2017	Evolution
Total number of students	17,102,282	20,401,724	20,394,492	20,183,886	+76.9%
Total number of institutions in the data	5,042	5,756	6,539	6,411	+145%
Mean of per student revenue from tuition	\$6,452	\$7,113	\$8,418	\$8,543	+174%
Top 0.1% of students	\$40,783	\$42,453	\$50,172	\$53,048	+162%
Percentage of the overall revenue from tuition	0.88%	0.81%	0.89%	0.86%	
Top 0.5% of students	\$30,014	\$31,924	\$35,853	\$36,972	+123%
Percentage of the overall revenue from tuition	2.90%	2.71%	2.73%	2.42%	
Top 1% of students	\$28,605	\$31,542	\$34,823	\$35,642	+129%
Percentage of the overall revenue from tuition	4.42%	4.64%	4.66%	4.56%	
Top 10% of students	\$16,285	\$17,597	\$19,867	\$19,956	+142%
Percentage of the overall revenue from tuition	34.18%	33.41%	31.84%	32.24%	
Bottom 50% of students	\$4,194	\$4,684	\$5,927	\$5,977	+222%
Percentage of the overall revenue from tuition	14.31%	13.56%	14.39%	14.60%	
Bottom 10% of students	\$768	\$760	\$923	\$969	+300%
Percentage of the overall revenue from tuition	0.78%	0.64%	0.66%	0.67%	

Reading: In 2017, the top 10% of student that have the higher revenue from tuition have revenue from tuition of \$19,956, they have 31.84% of the overall revenue from tuition.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS, Finance and Enrollment Data

Global Distribution of Spendings with alternative definition of higher educational spendings

Student oriented resources (without grants and scholarships)

Focusing on the global distribution of spendings with total student oriented resources, levels of inequalities are slightly higher than the one for instructional expenditures and have increase slightly more over time. The share of the top 10% was between 20.8% and 22.4% (compared to between 18.6% and 20% for instructional expenditure) in the 1970's and between 24.5% and 25.9% (21.2% and 22.5%) in the 1998.

Student oriented resources (with grants and scholarships)

Including grants and scholarships in the analysis almost doesn't change the global picture: this make sense as in the entire educational career, they only account for a small share of a few years of a long career of education.

Per student public total expenditure

With per student public expenditure, the order of magnitude are the same than for instructional spendings or for student-oriented resources with 5% dedicated to the top 1 and bottom 10 shares, respectively; 20% to the top 10 and 35% to the bottom 50. I observe an increase of inequalities in public resources for the 1998 cohort. Nevertheless, this is to be remembered that the definition of "public expenditure" over the years of IPEDS survey varies more than the one for instruction or other categories for instance.

Average tuition revenue

Focusing on the global distribution with average tuition, I observe that order of magnitudes are the same as with instructional expenditure and the distribution is fairly stable over time.

TABLE A7: Distribution of spendings with alternative spendings for higher education

	1970 cohort - Expenditure per student (without grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$88,523		\$88,523
Top 0.1%	0.93%	\$570,746	1.25%	\$541,175
Top 0.5%	2.70%	\$307,460	2.99%	\$331,110
Top 1%	4.28%	\$249,852	4.67%	\$268,162
Top 10%	20.8%	\$129,619	22.4%	\$140,998
Bottom 50%	34.9%	\$77,427	33.4%	\$75,045
Bottom 10%	4.97%	\$50,753	3.80%	\$41,675
	1998 cohort - Expenditure per student (without grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$163,794		\$163,794
Top 0.1%	1.08%	\$1,248,229	1.29%	\$1,482,988
Top 0.5%	3.42%	\$813,948	3.71%	\$839,131
Top 1%	5.60%	\$601,550	5.91%	\$616,017
Top 10%	24.5%	\$253,982	25.9%	\$278,054
Bottom 50%	32.6%	\$131,646	30.7%	\$121,803
Bottom 10%	5.10%	\$96,886	4.47%	\$98,070
	2005 cohort - Expenditure per student (without grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$177,896		\$177,896
Top 0.1%	1.17%	\$1,401,365	1.33%	\$1,555,891
Top 0.5%	3.57%	\$909,083	3.84%	\$944,647
Top 1%	5.80%	\$675,303	6.11%	\$694,487
Top 10%	25.5%	\$281,332	27.0%	\$307,907
Bottom 50%	31.9%	\$136,625	30.1%	\$130,831
Bottom 10%	5.24%	\$103,492	4.72%	\$101,878

Reading: Among those that entered first grade in 2005, the bottom 50 percent of spendings had spendings between \$130,831 (hypothesis 2) and \$136,625 (hypothesis 1). They had between 30.1% and 31.9% of the overall spendings.

Sample: 1970- 1982 School Districts and 1982 colleges for the 1970 cohort; 1998-2010 School Districts and 2010 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are student oriented resources without grants and scholarships.

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

TABLE A8: Distribution of spendings with alternative spendings for higher education

	1970 cohort - Expenditure per student (with grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$89,447		\$89,447
Top 0.1%	.933%	\$581,521	1.24%	\$541,627
Top 0.5%	2.77%	\$319,594	3.07%	\$345,099
Top 1%	4.42%	\$259,898	4.81%	\$276,870
Top 10%	21.2%	\$131,711	22.8%	\$143,881
Bottom 50%	34.6%	\$77,516	33.0%	\$75,045
Bottom 10%	4.92%	\$50,761	3.76%	\$41,675
	1998 cohort - Expenditure per student (with grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$165,551		\$165,551
Top 0.1%	1.08%	\$1,256,118	1.28%	\$1,483,266
Top 0.5%	3.42%	\$813,948	3.71%	\$839,131
Top 1%	5.59%	\$601,550	5.90%	\$619,136
Top 10%	24.6%	\$255,050	25.9%	\$281,312
Bottom 50%	32.3%	\$131,774	30.4%	\$123,023
Bottom 10%	5.07%	\$97,195	4.42%	\$98,070
	2005 cohort - Expenditure per student (with grants)			
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$181,725		\$181,725
Top 0.1%	1.15%	\$1,403,164	1.32%	\$1,557,690
Top 0.5%	3.52%	\$918,922	3.79%	\$953,650
Top 1%	5.73%	\$684,598	6.04%	\$705,317
Top 10%	25.4%	\$288,309	26.9%	\$315,478
Bottom 50%	31.6%	\$139,623	29.6%	\$134,017
Bottom 10%	5.18%	\$104,185	4.62%	\$101,878

Reading: Among those that entered first grade in 2005, the bottom 50 percent of spendings had spendings between \$134,017 (hypothesis 2) and \$139,623 (hypothesis 1). They had between 29.6% and 31.6% of the overall spendings.

Sample: 1970- 1982 School Districts and 1982 colleges for the 1970 cohort; 1998-2010 School Districts and 2010 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are student oriented resources with grants and scholarships.

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

TABLE A9: Distribution of spendings with public spendings (federal, state, local) per student for higher education

1970 cohort - Public (federal, state, local governments) per student expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$86,771		\$86,771
Top 0.1%	1.23%	\$514,555	1.36%	\$557,359
Top 0.5%	3.01%	\$296,809	3.20%	\$323,837
Top 1%	4.55%	\$242,856	4.86%	\$268,373
Top 10%	21.2%	\$126,199	22.7%	\$135,656
Bottom 50%	35.1%	\$75,130	34.1%	\$75,045
Bottom 10%	5.00%	\$50,350	3.88%	\$41,675
1998 cohort -Public (federal, state, local) per student expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$171,401		\$171,401
Top 0.1%	2.94%	\$1,780,682	3.72%	\$2,024,361
Top 0.5%	5.63%	\$775,680	6.48%	\$784,720
Top 1%	7.51%	\$564,871	8.37%	\$586,561
Top 10%	26.7%	\$269,397	28.5%	\$295,711
Bottom 50%	31.1%	\$131,411	29.2%	\$117,349
Bottom 10%	4.79%	\$95,063	4.27%	\$98,070
2005 cohort -Public (federal, state, local) per student expenditure				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$167,411		\$167,411
Top 0.1%	1.18%	\$1,269,150	1.36%	\$1,423,675
Top 0.5%	3.26%	\$631,121	3.50%	\$659,882
Top 1%	5.01%	\$538,227	5.30%	\$558,101
Top 10%	24.0%	\$266,609	25.5%	\$291,045
Bottom 50%	33.2%	\$130,465	31.8%	\$125,050
Bottom 10%	5.41%	\$101,248	5.02%	\$101,878

Reading: Among those that entered first grade in 2005, the bottom 50 percent of public spendings had public spendings between \$125,050 (hypothesis 2) and \$130,465 (hypothesis 1). They had between 29.6% and 31.6% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 1998-2005 School Districts and 2005 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are public expenditures ^a only.

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

^aTo compute public expenditures I compute the share of federal revenue (federal appropriations and federal unrestricted and restricted grants), state revenue (state appropriations and state unrestricted and restricted grants) and local revenue (local appropriations and local unrestricted and restricted grants) and divide it by fall enrollment to have per student expenditure.

TABLE A10: Distribution of spendings with average tuition revenue per student for higher education

1970 cohort - Average tuition revenue				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$81,593		\$81,593
Top 0.1%	0.73%	\$307,772	0.87%	\$322,114
Top 0.5%	1.97%	\$221,545	2.19%	\$241,627
Top 1%	3.24%	\$194,040	3.58%	\$214,584
Top 10%	18.4%	\$112,423	19.6%	\$116,218
Bottom 50%	37.8%	\$75,049	36.8%	\$75,045
Bottom 10%	5.77%	\$52,238	4.63%	\$46,306

1998 cohort - Average tuition revenue				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$140,645		\$140,645
Top 0.1%	0.60%	\$672,653	0.67%	\$771,730
Top 0.5%	1.97%	\$415,743	2.09%	\$432,431
Top 1%	3.36%	\$370,447	3.55%	\$389,381
Top 10%	20.1%	\$208,555	21.4%	\$224,916
Bottom 50%	36.7%	\$120,400	35.8%	\$115,944
Bottom 10%	6.06%	\$95,296	5.43%	\$98,070

2005 cohort - Average tuition revenue				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$156,673		\$156,673
Top 0.1%	0.66%	\$775,184	0.73%	\$793,700
Top 0.5%	2.09%	\$490,648	2.23%	\$518,930
Top 1%	3.56%	\$437,035	3.77%	\$450,280
Top 10%	21.4%	\$248,197	22.8%	\$260,027
Bottom 50%	35.0%	\$131,681	33.9%	\$123,158
Bottom 10%	5.78%	\$100,872	5.36%	\$101,878

Reading: Among those that entered first grade in 2005, the bottom 50 percent of tuition revenue had tuition revenue between \$123,158 (hypothesis 2) and \$131,681 (hypothesis 1). They had between 33.9% and 35.0% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 1998-2005 School Districts and 2005 colleges for the 1998 cohort, 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education tuition revenue divided by fall enrollment only.

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

Hypothetical distribution of spendings with average total expenditure for higher education

TABLE A11: Hypothetical distribution of spendings with average total expenditure for higher education

1970 cohort - 2005 Educational Attainment				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$115,885		\$115,885
Top 0.1 %	1.40%	\$1,451,524	2.08%	\$1,428,332
Top 0.5 %	4.66%	\$655,113	5.09%	\$654,359
Top 1 %	7.05%	\$484,351	7.48%	\$499,975
Top 10 %	27.5%	\$192,747	28.6%	\$201,489
Bottom 50 %	29.1%	\$88,136	27.0%	\$81,824
Bottom 10 %	4.43%	\$56,874	3.87%	\$55,567
2005 cohort - 1970 Educational Attainment				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$177,798		\$177,798
Top 0.1 %	2.68%	\$2,366,398	3.14%	\$2,571,674
Top 0.5 %	6.28%	\$1,189,299	6.92%	\$1,245,657
Top 1 %	9.07%	\$880,166	9.79%	\$908,523
Top 10 %	30.0%	\$262,825	32.8%	\$300,781
Bottom 50 %	30.6%	\$126,916	28.9%	\$121,388
Bottom 10 %	4.89%	\$98,049	3.99%	\$84,899

Reading: If those that entered first grade in 2005 had the educational attainment of the 1970's, the bottom 50 percent of individuals would have average total expenditure between \$126,916 (hypothesis 1) and \$174,686(hypothesis 2). They would have between 24.6 % and 30.6% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are total expenditures (also include research expenditure).

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

TABLE A12: Hypothetical distribution of spendings with average total expenditure for higher education

1970 cohort - Everyone Bachelor				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$139,818		\$139,818
Top 0.1 %	1.59%	\$1,274,955	1.59%	\$1,274,955
Top 0.5 %	4.12%	\$664,618	4.12%	\$664,618
Top 1 %	6.16%	\$501,194	6.16%	\$501,194
Top 10 %	24.6%	\$213,125	24.6%	\$213,125
Bottom 50 %	31.3%	\$118,228	31.3%	\$118,228
Bottom 10 %	4.48%	\$70,861	4.48%	\$70,861
2005 cohort - Everyone Bachelor				
	Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)
Mean spendings		\$250,298		\$250,298
Top 0.1 %	2.28%	\$3,593,451	2.28%	\$3,593,451
Top 0.5 %	5.37%	\$1,632,001	5.37%	\$1,632,001
Top 1 %	8.05%	\$1,100,904	8.05%	\$1,100,904
Top 10 %	30.3%	\$408,122	30.3%	\$408,122
Bottom 50 %	29.1%	\$182,887	29.1%	\$182,887
Bottom 10 %	4.63%	\$128,208	4.63%	\$128,208

Reading: If those that entered first grade in 2005 would all go until bachelor studies, the bottom 50 percent of individuals would have \$182887 in spendings. They would have 29.1% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are total expenditures (also include research expenditure).

Sources: Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education

TABLE A13: Hypothetical distribution of spendings with average total expenditure for higher education

1970 cohort - Everyone mean spendings					
		Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)	
Mean spendings		\$201,349		\$201,349	
Top 0.1 %	0.13%	\$276,403	0.14%	\$276,403	
Top 0.5 %	0.68%	\$274,762	0.69%	\$274,762	
Top 1 %	1.36%	\$273,968	1.36%	\$273,968	
Top 10 %	13.0%	\$242,424	13.0%	\$242,424	
Bottom 50 %	42.2%	\$185,329	42.1%	\$200,073	
Bottom 10 %	7.12%	\$169,272	6.59%	\$147,440	

2005 cohort - Everyone mean spendings					
		Hypothesis 1		Hypothesis 2	
	Percentage of the overall spendings	Amount (in 2017 dollars)	Percentage of the overall spendings	Amount (in 2017 dollars)	
Mean spendings		\$186,913		\$186,913	
Top 0.1 %	0.18%	\$335,907	0.18%	\$335,907	
Top 0.5 %	0.88%	\$323,972	0.88%	\$323,972	
Top 1 %	1.74%	\$321,802	1.74%	\$321,802	
Top 10 %	15.7%	\$265,385	15.7%	\$265,385	
Bottom 50 %	41.0%	\$155,806	40.7%	\$155,806	
Bottom 10 %	7.70%	\$105,806	7.39%	\$105,806	

Reading: If those that entered first grade in 2005 would all go until bachelor studies, the bottom 50 percent of individuals would have \$182887 in spendings. They would have 29.1% of the overall spendings.

Sample: 1970- 1981 School Districts and 1980 colleges for the 1970 cohort; 2005-2017 School Districts and 2017 colleges for the 2005 cohort

N.B.: Expenditure for K-12 education are total educational expenditures whereas expenditure for higher education are total expenditures (also include research expenditure)

Sources: *Annual Survey of State and Local Government Finances for K-12 education and IPEDS for Higher Education*

APPENDIX B: ROBUSTNESS CHECK: CONSTANT COVERAGE OF INSTITUTIONS

Elementary education

To study if the stability of inequality would have been the same with a constant sample of district, I compute longitudinal analysis (for the 1970-1982 and 1998-2009 cohorts) based on a constant sample of districts. For the 1970-1982 cohort, among the 15,688 districts that existed at some point in the data, 3,633 report positive enrollment and spendings data from 1970-1982. For the 1998-2009 cohort, among the 15,981 districts that existed at some point in the data, 13,814 report positive enrollment and spendings data from 1998-2009. With a constant coverage of districts, results are very similar to the one with all districts present in the database. Results for the 1970's cohort are slightly more equally distributed but I am only able to include a few districts over the entire periods.

TABLE A14: Distribution of per pupil Spendings for 12 years of elementary or secondary Education in the 1970's and in the 1990's-2000's with a constant coverage of Districts

	1970-1981		1998-2009	
	Percentage of the Overall spendings	Amount (in 2017 dollar)	Percentage of the Overall spendings	Amount (in 2017 dollar)
Mean spendings		\$78,093		\$126,486
Top 0.1%	0.35%	\$193,513	0.57%	\$571,470
Top 0.5%	1.28%	\$161,559	1.52%	\$276,027
Top 1%	2.25%	\$147,523	2.59%	\$248,907
Top 10%	15.4%	\$100,966	16.7%	\$173,421
Bottom 50%	42.1%	\$75,051	41.0%	\$114,977
Bottom 10%	6.55%	\$56,237	7.15%	\$98,073

Reading: In the 1970's, the top 10% of students for whom the most is spent have spendings above \$100,966 (in 2017 dollars), they have 15.4% of the overall spendings.

Sample: 1970-1981 School Districts and 1998-2009 School districts with a constant coverage of districts (3,633 in the 1970's and 15,981 in the 1990's-2000's)

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1985* and *Public Elementary-Secondary Education Finance Data for 1990-2016, US Census Bureau*

Higher education

To study if the increase in inequalities in spendings observed at the higher education level is linked to the arrival of new institutions (particularly of private for-profit institutions (Figure 1.5)), I compute the evolution of the distribution of spendings (to compare them to Table 5.1 and Table 5.2) based on a constant coverage of institutions. I am left with a sample of 2,478 institutions for the 40 years instead of the 7,121 that existed at some point in the period.

Both for the cross-sectional analysis and the longitudinal analysis, order of magnitude in terms of the concentration of instructional spendings are of the same order of magnitude as the one with all institutions presents in the data with in 2017, slightly more than 1% of the spendings for the top 0.1% of students, 10% for the top 1%, 35% for the top 10%, 20% for the bottom 50% of students and 2% for the bottom 10% of students for whom the less is spend in instructional spendings for higher education.

In real terms, increase in instructional spendings are higher with a constant coverage of institutions than for the sample of all institutions. For the cross-sectional analysis, the top 1% of student has known an increase of 275% with a constant coverage of institutions and of 175% with all institutions between 1980 and 2017; the bottom 50% has known an increase of 62% with a constant coverage of institutions and of 49% with all institutions. For the longitudinal analysis, the higher increase with the

constant sample of institutions is even more pronounced with an increase of the average spendings of 529% instead of 91% with all institutions. This means that new institutions arriving in the data and institutions that are only present at some point of the period tends to have a lower spendings than the one existing all over the period and to mitigate the increase in spendings over the period. The increase in inequalities observed at the higher education level is thus not linked to the arrival of new institutions like for-profit institutions for instance.

TABLE A15: Evolution of cost and distribution of instructional expenditure per student from 1980 to 2017 in constant 2017 dollars with a constant coverage of institutions (cross-sectional analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	10,839,427	10,925,843	12,290,499	12,521,548	13,165,966
Total number of institutions in the data	2,478	2,478	2,478	2,478	2,478
Mean of per student spending	\$4,938	\$5,594	\$7,869	\$6,547	\$7,355
Top 0.1% of students	\$59,980	\$76,390	\$104,422	\$75,313	\$98,776
Percentage of the overall spending	1.35%	1.73%	1.99%	2.02%	1.83%
Top 0.5% of students	\$27,790	\$32,516	\$57,740	\$49,348	\$52,675
Percentage of the overall spending	4.54%	4.45%	5.84%	5.84%	5.59%
Top 1% of students	\$19,392	\$22,323	\$42,410	\$33,275	\$39,711
Percentage of the overall spending	6.949%	6.820%	8.199%	7.789%	8.630%
Top 10% of students	\$8,208	\$9,293	\$13,582	\$11,397	\$12,962
Percentage of the overall spending	27.87%	28.79%	32.27%	32.06%	33.52%
Bottom 50% of students	\$4,044	\$4,489	\$5,897	\$4,937	\$5,332
Percentage of the overall spending	26.01%	25.63%	24.40%	24.00%	22.88%
Bottom 10% of students	\$1,765	\$1,950	\$2,623	\$2,167	\$2,315
Percentage of the overall spending	3.06%	2.90%	2.86%	2.89%	2.70%
	2005	2010	2015	2017	Evolution
Total number of students	14,624,836	16,715,148	16,436,194	16,427,054	+ 51.55%
Total number of institutions in the data	2,478	2,478	2,478	2,478	+ 0%
Mean of per student spending	\$7,792	\$8,513	\$9,680	\$9,868	+ 95.79%
Top 0.1% of students	\$91,595	\$108,654	\$135,969	\$130,375	+ 117.36%
Percentage of the overall spending	1.71%	1.18%	0.95%	1.24%	
Top 0.5% of students	\$61,907	\$71,174	\$81,734	\$85,767	+ 208.63%
Percentage of the overall spending	5.72%	5.51%	6.67%	5.44%	
Top 1% of students	\$56,185	\$58,225	\$69,368	\$72,582	+ 275.32%
Percentage of the overall spending	9.16%	9.43%	9.72%	10.10%	
Top 10% of students	\$13,226	\$15,395	\$16,447	\$17,406	+ 112.06%
Percentage of the overall spending	35.63%	34.97%	35.45%	35.68%	
Bottom 50% of students	\$5,411	\$6,049	\$6,594	\$6,532	+ 61.52%
Percentage of the overall spending	21.95%	21.51%	21.65%	21.11%	
Bottom 10% of students	\$2,450	\$2,584	\$2,961	\$2,874	+ 62.83%
Percentage of the overall spending	2.75%	2.55%	2.53%	2.38%	

Reading: With a constant coverage of institutions, in 2017, the top 10% of student for whom the most is spent have spendings above \$17,406, they have 35.68% of the overall spendings.

Sample: 1980's - 2010's colleges and universities - constant sample of 3,480 institutions

Sources: IPEDS, Finance and Enrollment data

TABLE A16: Evolution of cost and distribution of instructional expenditure per student from 1980 to 2017 in constant 2017 with a constant coverage of institutions (longitudinal analysis)

	1980	1985	1990	1995	2000
Total number of students in the data	10,839,427	10,925,843	12,290,499	12,521,548	13,165,966
Total number of institutions in the data	3,480	3,480	3,480	3,480	3,480
Mean of per student spending	\$5,938	\$9,138	\$15,521	\$15,234	\$19,280
Top 0.1% of students	\$76,865	\$132,749	\$219,130	\$186,453	\$274,640
Percentage of the overall spending	1.44%	1.84%	2.11%	2.14%	1.94%
Top 0.5% of students	\$35,614	\$56,505	\$121,169	\$124,946	\$146,460
Percentage of the overall spending	4.84%	4.73%	6.21%	5.18%	5.93%
Top 1% of students	\$24,851	\$38,793	\$88,997	\$82,378	\$110,413
Percentage of the overall spending	7.40%	7.26%	8.73%	8.28%	9.15%
Top 10% of students	\$10,518	\$16,005	\$28,376	\$28,215	\$36,040
Percentage of the overall spending	29.63%	30.93%	34.31%	34.11%	35.54%
Bottom 50% of students	\$5,093	\$7,586	\$12,095	\$11,915	\$14,492
Percentage of the overall spending	21.53%	21.10%	19.94%	19.34%	18.48%
Bottom 10% of students	\$1,259	\$1,820	\$2,936	\$2,930	\$3,434
Percentage of the overall spending	1.76%	1.65%	1.59%	1.64%	1.49%
	2005	2010	2015	2017	Evolution
Total number of students	14,624,836	16,715,148	16,436,194	16,427,054	+51.55%
Total number of institutions in the data	3,480	3,480	3,480	3,480	+0%
Mean of per student spending	\$23,119	\$28,570	\$35,180	\$37,371	+529.35%
Top 0.1% of students	\$287,716	\$387,810	\$523,423	\$521,498	+ 578,46%
Percentage of the overall spending	1.81%	1.26%	1.00%	1.31%	
Top 0.5% of students	\$194,460	\$254,038	\$314,643	\$343,067	+ 863,29%
Percentage of the overall spending	6.05%	5.86%	7.06%	5.75%	
Top 1% of students	\$176,488	\$207,818	\$267,036	\$290,327	+ 1068,27%
Percentage of the overall spending	9.69%	10.02%	10.30%	10.68%	
Top 10% of students	\$41,544	\$54,950	\$63,314	\$69,626	+ 561,97%
Percentage of the overall spending	37.72%	37.20%	37.54%	37.68%	
Bottom 50% of students	\$16,775	\$21,144	\$24,965	\$25,646	+ 403,55%
Percentage of the overall spending	17.65%	16.65%	17.25%	16.88%	
Bottom 10% of students	\$4,049	\$5,055	\$6,416	\$6,514	+ 417,34%
Percentage of the overall spending	1.51%	1.50%	1.54%	1.48%	

Reading: With a constant coverage of institutions, in 2017, the top 10% of student for which I spend the more have spendings above \$69,626 , they have 37.68% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS, Finance and Enrollment Data

APPENDIX C: ROBUSTNESS CHECK: DISTRIBUTION OF EDUCATIONAL EXPENDITURE WITH TRIMMED DATABASE

K-12 Education

To see if the distribution of spendings doesn't rely on outliers, especially at the top, I trim outlier values (above \$100,000 per pupil per year in 1970 and I then multiply the higher value by the average increase in per pupil spendings). As I want to focus on the top of the distribution (top 1%, top 0,5%, top 0,1%), it wouldn't make sense to trim all the value above the 99th percentile of spendings for instance.

This doesn't change the distribution a lot. The level of concentration is slightly lower in the 1970's and in the 1980's than in the main specification (due to the nature of the data used, there are more outliers in the 1970's-1980's than in the most recent period), but order of magnitude stay the same.

TABLE A17: Evolution of Cost and Distribution of per pupil Expenditure from 1967 to 2016 in constant 2017 dollars (cross-sectional analysis) with outliers trimmed

	1967	1970	1975	1980	1985	1990
Mean of per student spending	\$4,814	\$5,673	\$6,182	\$6,780	\$7,480	\$8,492
Top 0.1 % of students	\$18,453	\$21,577	\$19,043	\$18,788	\$20,715	\$25,652
Percentage of the overall spending	0.47%	0.47%	0.44%	0.43%	0.37%	0.40%
Top 0.5 % of students	\$12,144	\$15,975	\$15,531	\$14,612	\$16,800	\$20,135
Percentage of the overall spending	1.62%	1.72%	1.5%	1.38%	1.33%	1.42%
Top 1 % of students	\$10,327	\$13,842	\$12,984	\$13,103	\$15,187	\$18,081
Percentage of the overall spending	2.75%	3.04%	2.65%	2.39%	2.42%	2.53%
Top 10 % of students	\$6,584	\$7,954	\$8,418	\$8,913	\$9,971	\$12,165
Percentage of the overall spending	16.8%	18%	16.8%	15.8%	16.1%	16.6%
Bottom 50 % of students	\$4,540	\$5,367	\$5,864	\$6,556	\$7,187	\$7,926
Percentage of the overall spending	38.9%	37.2%	38.6%	40.0%	39.7%	39.0%
Bottom 10 % of students	\$3,242	\$3,586	\$4,249	\$4,744	\$5,217	\$5,794
Percentage of the overall spending	5.88%	5.48%	6.05%	6.21%	5.78%	6.19%
	1995	2000	2005	2010	2016	
Mean of per student spending	\$8,761	\$9,723	\$10,863	\$11,635	\$11,828	
Top 0.1 % of students	\$24,641	\$45,439	\$48,908	\$44,358	\$38,616	
Percentage of the overall spending	0.33%	0.58%	0.65%	0.58%	0.53%	
Top 0.5 % of students	\$19,815	\$20,650	\$24,982	\$26,713	\$27,976	
Percentage of the overall spending	1.33%	1.62%	1.67%	1.65%	1.60%	
Top 1 % of students	\$17,950	\$18,773	\$21,942	\$24,225	\$25,547	
Percentage of the overall spending	2.40%	2.63%	2.75%	2.71%	2.73%	
Top 10 % of students	\$12,307	\$13,043	\$14,968	\$16,426	\$17,196	
Percentage of the overall spending	15.4%	16.2%	17.1%	18%	18.7%	
Bottom 50 % of students	\$8,108	\$8,964	\$9,819	\$10,326	\$10,481	
Percentage of the overall spending	40.0%	41.3%	40.4%	39.5%	38.3%	
Bottom 10 % of students	\$6,435	\$7,561	\$8,243	\$8,613	\$8,488	
Percentage of the overall spending	6.86%	7.17%	7.01%	6.82%	6.48%	

Reading: In 2016, the top 10% of student for whom the most is spent have spendings above \$17,196 per year, they have 18.7% of the overall spendings.

Sample: 1967-2016 school districts

Sources: *Historical Finances of Individual Governments (IndFin) for 1967-1985 and Public Elementary-Secondary Education Finance Data for 1990-2016, US Census Bureau*

Higher Education

To study if the analysis is robust to outliers, I trim the database at five times the 99th percentile for instruction per student and average total expenditure. As I am interested in the concentration at the top, I don't want to trim at the 99th percentile as the 1% represents more than 10% of the spendings in 2017.

TABLE A18: Evolution of cost and distribution of instruction per student from 1980 to 2017 in constant 2017 dollars (cross-sectional analysis) with trimmed database at 5*p99.

	1980	1985	1990	1995	2000
Mean of per student spending	\$4,787	\$5,387	\$7,552	\$6,284	\$7,128
Top 0.1 % of students	\$50,742	\$58,786	\$95,350	\$70,156	\$98,776
Percentage of the overall spending	1.269%	1.269%	1.350%	1.299%	2.069%
Top 0.5 % of students	\$27,790	\$32,314	\$57,740	\$49,348	\$52,675
Percentage of the overall spending	3.829%	4%	4.550%	4.829%	5.869%
Top 1 % of students	\$19,392	\$22,113	\$38,212	\$31,774	\$37,711
Percentage of the overall spending	6.190%	6.340%	8.140%	7.829%	9.15%
Top 10 % of students	\$8,213	\$9,150	\$12,943	\$11,249	\$12,604
Percentage of the overall spending	27.79%	28.79%	31.69%	31.79%	34.04%
Bottom 50 % of students	\$3,932	\$4,333	\$5,716	\$4,776	\$5,108
Percentage of the overall spending	25.70%	25.25%	24.29%	23.82%	22.69%
Bottom 10 % of students	\$1,716	\$1,902	\$2,516	\$2,107	\$2,287
Percentage of the overall spending	3%	2.910%	2.769%	2.900%	2.670%
	2005	2010	2015	2017	Evolution
Mean of per student spending	\$7,259	\$7,661	\$8,681	\$8,868	+ 85.2%
Top 0.1 % of students	\$91,595	\$108,654	\$128,743	\$127,760	+ 151%
Percentage of the overall spending	1.769%	.6700%	1.320%	1.509%	
Top 0.5 % of students	\$61,907	\$69,909	\$81,734	\$83,432	+ 200%
Percentage of the overall spending	5.789%	5.429%	5.769%	6.070%	
Top 1 % of students	\$51,760	\$44,718	\$53,084	\$53,346	+ 175%
Percentage of the overall spending	9.609%	9.579%	10.14%	10.02%	
Top 10 % of students	\$12,542	\$14,315	\$15,723	\$16,172	+ 96.9%
Percentage of the overall spending	36.20%	35.56%	35.77%	35.88%	
Bottom 50 % of students	\$4,983	\$5,230	\$5,935	\$5,882	+ 49.5%
Percentage of the overall spending	21.18%	20.61%	20.82%	20.51%	
Bottom 10 % of students	\$2,271	\$2,369	\$2,571	\$2,561	+ 49.2%
Percentage of the overall spending	2.490%	2.309%	2.240%	2.160%	

Reading: In 2017, the top 10% of student for whom the most is spent have average total spendings above \$16,172, they have 35.88% of the overall spendings.

Sample: 1980's - 2010's colleges and universities

Sources: IPEDS (Integrated Postsecondary Education Data System), Finance and Enrollment Data

Trimming the database, the concentration at the top (particularly top 0.1 and top 0.5 % of students) is mechanically smaller but results stay of the same order of magnitude with around 10% at the end of the period for the top 1% of students, 35% for the top 10, 20% for the bottom 50 and a little bit more than 2% for the bottom 10%. I don't present results for the longitudinal analysis, but results are available upon request. Results for the evolution of spendings, with the top getting more increase than the bottom, are very similar, and even higher at the top.