Education

131 Undergraduate Public Economics
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Education

Education is one of the 3 largest program funded by government (along with retirement and health)

All advanced economies fund most (80% on average) of education (pre-K, K-12, higher ed) through government

⇒ Education level highly dependent on govt policy (see OECD stats)

In US, 4.5% of GDP or 1/7 of total government expenditure

In US, 80% of ed spending done at the state and local level

Focus of an extensive body of research in the rapidly expanding field of economics of education
Figure B2.1. Public and private expenditure on educational institutions, as a percentage of GDP (2013)

From public\(^1\) and private\(^2\) sources

<table>
<thead>
<tr>
<th>Country</th>
<th>Public expenditure on educational institutions</th>
<th>Private expenditure on educational institutions</th>
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<tbody>
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<td>Costa Rica</td>
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<td>Hungary</td>
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</tbody>
</table>

Note: Public expenditure figures presented here exclude undistributed programme.
1. Including public subsidies to households attributable to educational institutions, and direct expenditure on educational institutions from international sources.
2. Net of public subsidies attributable for educational institutions.
4. Public does not include international sources.

Countries are ranked in descending order of expenditure from both public and private sources on educational institutions.


Chart data: http://dx.doi.org/10.1787/888933297719.
Chart PF1.2.A Expenditure on education as % of GDP, by level of education and source of funds, 2013\(^a\)

Expenditure on primary, secondary and post-secondary non-tertiary and on tertiary education by public or private source\(^b\), as % of GDP

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Panel A. Public expenditure

<table>
<thead>
<tr>
<th>Country</th>
<th>Primary, secondary and post-secondary non-tertiary</th>
<th>Tertiary</th>
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<td>Norway</td>
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</tr>
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<td>Denmark</td>
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<td>Belgium</td>
<td>6.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Finland</td>
<td>5.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Portugal</td>
<td>5.8</td>
<td>0.6</td>
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<tr>
<td>Ireland</td>
<td>5.8</td>
<td>0.6</td>
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<td>New Zealand</td>
<td>5.6</td>
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<tr>
<td>Italy</td>
<td>5.6</td>
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</tr>
<tr>
<td>France</td>
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<td>Netherlands</td>
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<td>Austria</td>
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<td>Canada</td>
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<td>Switzerland</td>
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<td>Germany</td>
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<td>Russian Federation</td>
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<td>0.4</td>
</tr>
</tbody>
</table>

Panel B. Private expenditure

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\(a\) Data for Canada refer to 2012 and for Chile to 2014

\(b\) Public expenditure includes public subsidies to households attributable for educational institutions and direct expenditure on educational institutions from international sources. Private expenditure is presented net of public subsidies attributable for educational institutions.

\(c\) Public does not include international sources.

\(d\) The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: OECD Education at a Glance 2016
Why Should the Government Be Involved in Education?

**Fundamental reason:** education is long and costly (teachers + schools, US cost is $15K/year-kid) AND everybody needs it in modern economy

⇒ without govt provision, low income families would not be able to afford it for their kids (would hurt opportunity)

Governments developed mass education in 20th century [mandatory up to certain ages and publicly provided]

Played a big role in fostering economic development:

1) empowers women and fertility transition in devo countries

2) modern economy requires an educated workforce
Interpretation. In 2015, fiscal revenues represented 47% of national income on average in Western Europe and were used as follows: 10% of national income for regalian expenditure (army, police, justice, general administration, basic infrastructure: roads, etc.); 6% for education; 11% for pensions; 9% for health; 5% for social transfers (other than pensions); 6% for other social spending (housing, etc.). Before 1914, regalian expenditure absorbed almost all fiscal revenues. Note. The evolution depicted here is the average of Germany, France, Britain and Sweden (see figure 10.14). Sources and series: see piketty.pse.ens.fr/ideology.
Why Should the Government Be Involved in Education?

For economists, ex-ante not obvious because education does not look like a public good

1) Returns to education are largely private

2) Education is excludable

⇒ we should expect students to invest roughly the optimal amount in their own education
Why Should the Government Be Involved in Education?

Traditional motives pointed out by economists:

1) Externalities (productivity spillovers, crime, citizenship)

2) Borrowing constraints (poor but talented students may not be able to borrow against future earnings to get an education)

3) (MOST IMPORTANT) Family and individual failures (to conform to standard econ model):

   a) Some parents may not take good care of their children (public education provides opportunity for all)

   b) Young adults might not do what is in their long-run interest due to self-control problems or lack of information
1) Externalities of education on crime and voting

\[ Crime_i = \alpha + \beta Educi + \varepsilon_i \]

Observational regression comparing the educated vs. not-educated likely biased because propensity to crime \( \varepsilon_i \) is negatively correlated with \( Educi \).

Lochner and Moretti (2004) use as instrument changes in state compulsory attendance laws: State T increases compulsory attendance from 9 to 10 years at time \( t \), State C does not.

Can look at effect on education, and then look at effect on crime using Difference-in-difference

They show that an extra year of schooling reduces incarceration rates significantly

0.1 pct point decline for white males relative to a mean of 1%
0.3 pct point decline for black males relative to mean of 3%

⇒ Gap in schooling between whites and blacks accounts for more than 1/4 difference in crime rates

Social return to education exceeds private return by 25% based purely on reduction in crime

Moretti, Mulligan, Oreopoulos (2003) find positive effects of education on likelihood of voting using same strategy
2) Borrowing Constraints: effects of loans

If there are no borrowing constraints (and individuals are rational), current resources should not matter for educational decisions: invest in education only if PDV benefits > costs

Empirical evidence shows that availability of loans do matter suggesting that borrowing constraints are an issue

Solis (2017) studies the effects of guaranteed loans on college attendance in Chile

Guaranteed loan is available if test score of student (equivalent of SAT for Chile) is above threshold equal to 475.

Regression discontinuity design: does discontinuity in loan availability translate into discontinuity in college attendance? YES

⇒ Very compelling evidence that loan availability matters
College Enrollment; All Years; bw=2

Note: Each dot represents average college enrollment in an interval of 2 PSU points. The dashed lines represent fitted values from a 4th order spline and 95% confidence intervals for each side. The vertical line indicates the cutoff (475). These graphs show the full sample of students fulfilling all requirements to be eligible for college loans and taking the PSU immediately after graduating from high school.

Source: Solis (2013)
3) Behavioral motives (college application tutoring)

Carrell-Sacerdote (2017) carry out a field experiment in New Hampshire high-schools

College students from Dartmouth help senior high-schoolers to apply to college (weekly meetings in Winter semester)

Randomization within high schools: select only 50% of seniors

Find large positive impact on women (+15 points likelihood of enrolling in college) but small effects on men

Also find a cash bonus for applying to colleges without tutorial does not have any impact

⇒ Effects require time intensive tutorials (that parents/teachers typically should be providing)

Series of papers by Roland Fryer also show that paying K-12 kids to succeed does not work (kids don’t know how to succeed without guidance)
MEASURING THE RETURNS TO EDUCATION

Returns to education: The benefits that accrue to society when students get more schooling or when they get schooling from a higher-quality environment.

Effects of education levels on productivity

There is a large literature that shows that more education leads to higher wages in the labor market:

\[ Earnings_i = \alpha + \beta \cdot Education_i + \varepsilon_i \]

There is substantial controversy, however, over the implications of this correlation \((\beta > 0)\).
Effects of Education on Earnings

1) Education as Human Capital Accumulation

**human capital**: A person’s stock of skills, which may be increased by education

In that scenario, education raises earnings because it improves productivity

2) Education as a Screening Device

**screening**: A model that suggests that education provides only a means of separating high-ability from low-ability individuals and does not actually improve skills.

In that scenario, education raises **individual** earnings but it does not improve productivity (rat-race)
MEASURING THE RETURNS TO EDUCATION

Policy Implications

Under the human capital model, government would want to support education or at least provide loans to individuals so that they can get more education and raise their productivity.

Under the screening model, however, the government would not want to support more education for any given individual.

Differentiating the theories

Most of the returns to education reflect accumulation of human capital rather than screening.

Example: Clark-Martorell ’14 show that barely getting a high-school degree in Texas has no visible impact on later earnings.
student's score to be the minimum of these normalized scores. As such, students pass if and only if this normalized score is nonnegative. The dots are cell means, and the lines are fitted values from a regression of diploma receipt on a fourth-order polynomial in the score estimated separately on either side of the passing cutoff. The fraction of students with a diploma increases sharply as scores cross the passing threshold, from around 0.4 to 0.9. This implies that barely passing the last-chance exam substantially increases the probability of earning a diploma.

A. Main Estimates

We use fuzzy regression discontinuity methods (Angrist and Lavy 1999; Hahn et al. 2001) to exploit this discontinuity. In particular, we use passing status on the last-chance exam as an instrumental variable for diploma receipt in models that control for flexible functions of the exam scores (i.e., the variable on the horizontal axis in fig. 1). More formally, we estimate the following equations:

\[ Y_i = b_0 + b_1 D_i + f(p_i) + \varepsilon_i; \]

FIG. 1.—Last-chance exam scores and diploma receipt. The graphs are based on the last-chance sample. See table 1 and the text. Dots are test score cell means. The scores on the x-axis are the minimum of the section scores (recentered to be zero at the passing cutoff) that are taken in the last-chance exam. Lines are fourth-order polynomials fitted separately on either side of the passing threshold.

Source: Clark and Martorell JPE'14
tus even in the last-chance sample of students who remain in school until the end of grade 12. We return to this point in our discussion of the findings. Third, there is no indication of any jump in earnings at the passing cutoff.

The estimated discontinuities reported in table 3 are consistent with this last assertion. For each earnings outcome (i.e., for each year grouping), columns 1–4 report estimated discontinuities for first- through fourth-order polynomials, where the polynomials are fully interacted with an indicator for passing the last-chance exam. For each outcome, the estimated discontinuities are small in magnitude, small relative to the mean earnings of those who barely failed the exam (col. 1) and statistically indistinguishable from zero. Moreover, the estimates are robust to the choice of polynomial. Goodness-of-fit statistics suggest that the second-order polynomial is the preferred specification, and column 5 reports estimates from a model that uses this preferred polynomial and controls for baseline covariates. In column 6 we report estimates from a model in which the coefficients of the polynomial are restricted to be the same on either side of the passing cutoff. These estimates are more pre-

**Fig. 2.—**Earnings by last-chance exam scores. The graphs are based on the last-chance samples. See table 1 and the text. Dots are test score cell means. The scores on the x-axis are the minimum of the section scores (recentered to be zero at the passing cutoff) that are taken in the last-chance exam. Lines are fourth-order polynomials fitted separately on either side of the passing threshold.

Source: Clark and Martorell JPE'14
Evidence on the Returns to Education and Screening

Basic observational approach:

\[ Earnings_i = \alpha + \beta \cdot Education_i + \varepsilon_i \]

Amounts to comparing the earnings of people with different education.

Issue: ability to earn \( \varepsilon_i \) might be correlated with education choices

Two methods try to control for this bias in estimating the true human capital effects of education

1) Control for underlying ability by adding variables (e.g. SAT score) in the regression so that any remaining effect of education represents true productivity effects (omitted variable bias remains a concern)

2) Find exogenous variation in education (e.g., policy change induces more education for some group but not for another group)

Although all of these approaches have some limitations, the result of the analysis is surprisingly consistent: each additional year of education raises wages by 7-10%
THE IMPACT OF SCHOOL QUALITY

A number of approaches have been taken to estimate the impact of school quality on student test scores.

Two approaches have been used to address this issue: experimental data, and quasi-experimental using policy changes.

Findings suggest that the outcomes of efforts to improve school quality can be very dependent on the approach taken to improvements.
Estimating the Effects of Class Size

**Experimental example:** The state of Tennessee implemented Project STAR in 1985, randomly assigning 11,000 students (grades K–3) to small classes (13–17 students) or regular classes (22–25 students).

Krueger and Whitmore 2001 shows positive effects of small class size on test scores.

Chetty et al. 2011 linked students to college enrollment and adult earnings data: finds small positive effects on college enrollments and adult earnings.

Note: kids and teachers also randomly assigned across classes: strong class effects are visible (due to teachers or peers) and they have long-term effects on college and earnings.

**Quasi-experimental example:** By the mid-1990s, California had the largest class sizes in the nation (29 students per class on average). The California state government in 1996 provided strong financial incentives for schools to reduce their class size to 20 students per class: not much effects on outcomes found but controversial.
Estimating the Effects of Charter Schools

Some districts have charter schools that are not subject to all state regulations for schools (more flexibility to recruit teachers / adjust hours / curriculum)

Oversubscribed charter schools use a lottery to assign admissions

Generates randomized experiment allowing to estimate the causal effect of charter schools by comparing lottery winners and lottery losers

Angrist, Pathak, Walters AEJ’13 carry out a comprehensive analysis of charter schools effects in Massachusetts

Find that urban charter schools boost achievement well beyond that of urban public school students, while non-urban charters reduce achievement from a higher baseline

⇒ Charter schools can have a positive or negative impact depending on what they do

Most effective approach to education: focus on instruction time, pupil comportment, selective teacher hiring, and focus on traditional math and reading skills.
Role of Government in supply of Higher Education

Private non-profit universities have inelastic supply (e.g., fixed student bodies at top schools such as Harvard)

Historically, expansion of supply was carried out by public institutions (state universities and community colleges): Example: 1960 Master plan for California with 3-tier system (Community, State, University of California)

Government push also central to increase attendance: GI Bill after WWII/Korea War increased college attendance by 15-20 points for men born 1921-1933 (Stanley QJE’03)

Recently, states have retreated and supply has been provided by for-profit schools (get about 10% of total enrollment today) Deming-Goldin-Katz ’12 show that for-profit schools provide little benefits, charge a lot, and are savvy at exploiting Fed Pell Grants and saddle students with debt

⇒ Symptom of market failure due to individual failures/lack of information
The early period of gender parity in college enrollments from 1900 to 1930 (covering the birth cohorts of 1880 to 1910) was not the result of a situation where only an elite class sent children of both genders to college. Just 5 percent of the women enrolled in privately-controlled colleges in 1925 attended the elite “seven-sister” schools and only 22 percent were in any all-women’s college. Half of all American college students in 1925 were in publicly-controlled institutions of higher education, and 55 percent of women were. A substantial fraction of women during this period attended teacher-training colleges, and many of these schools had two-year programs. In 1925, for example, 30 percent of the female enrollments.

**Figure 1**
College Graduation Rates (by 35 years) for Men and Women: Cohorts Born from 1876 to 1975

*Sources:* 1940 to 2000 Census of Population Integrated Public Use Micro-data Samples (IPUMS).
Role of Higher Education in Intergenerational Mobility

Chetty et al. ’20 compile college level statistics on parental income and student earnings outcomes. Data online at [web].

1) **Access:** Huge variation in access across schools: Ivy league has more kids from top 1% families than from bottom 50% Giving poor kids an SAT point boost in admissions (as done for legacy students) could close gap and increase intergenerational mobility

2) **Outcomes:** Within good colleges, outcomes of poor vs. rich kids are similar ⇒ college is the ticket to opportunity

3) **Mobility rates:** Large discrepancies across colleges in fraction of students who come from bottom 20% and reach top 20% (=mobility rate)

4) **Trends:** fraction poor kids stagnated in top schools (in spite of more financial aid) and dropped at best public schools and community colleges
Which colleges in America contribute the most to helping children climb the income ladder? How can we increase access to such colleges for children from low income families? We take a step toward answering these questions by constructing publicly available mobility report cards—statistics on students' earnings in their early thirties and their parents' incomes—for each college. We estimate these statistics using de-identified data from the federal government covering all students from 1999-2013, building on the Dept. of Education's College Scorecard.

Mobility Report Cards for Columbia and SUNY-Stony Brook

Using these mobility report cards, we document four results.

1. Access. Access to colleges varies substantially across the income distribution, for example as shown between Columbia and SUNY-Stony Brook in the figure above. At "Ivy-Plus" colleges (Ivy League colleges, U. Chicago, Stanford, MIT, and Duke), more students come from families in the top 1% of the income distribution than the bottom half of the income distribution. Despite the generous financial aid offered by these institutions, students from the lowest-income families are particularly under-represented, even relative to middle-income students. Children with parents in the top 1% are 77 times more likely to attend an Ivy-Plus college than children with parents in the bottom 20%. More broadly, looking across all colleges, the degree of income segregation is comparable to income segregation across neighborhoods in the average American city. These findings challenge the perception that colleges foster interaction between children from diverse socioeconomic backgrounds.

Note: Bars show estimates of the fraction of parents in each quintile of the income distribution. Lines show estimates of the fraction of students from each of those quintiles who reach the top quintile as adults.
## Mobility Report Cards: Executive Summary

Visit www.equality-of-opportunity.org for the full paper, college-level data, and more.

### 2. Outcomes.

At any given college, students from low- and high-income families have very similar earnings outcomes. For example, about 60% of students at Columbia reach the top fifth from both low and high income families. In this sense, colleges successfully “level the playing field” across enrolled students with different socioeconomic backgrounds. This finding suggests that students from low-income families who are admitted to selective colleges are not over-placed, since they do nearly as well as students from more affluent families. This result also suggests that colleges do not bear large costs in terms of student outcomes for any affirmative action that they grant students from low-income families in the admissions process.

### 3. Mobility Rates.

We characterize differences in rates of upward mobility between colleges by defining a college’s upward mobility rate as the fraction of its students who come from a family in the bottom fifth of the income distribution and end up in the top fifth. Each college’s mobility rate is the product of access, the fraction of its students who come from families in the bottom fifth, and its success rate, the fraction of such students who reach the top fifth.

Mobility rates vary substantially across colleges because there are large differences in access across colleges with similar success rates. Ivy-Plus colleges have the highest success rates, with almost 60% of students from the bottom fifth reaching the top fifth. But certain less selective universities have comparable success rates while offering much higher levels of access to low-income families. For example, 51% of students from the bottom fifth reach the top fifth at SUNY–Stony Brook. Because 16% of students at Stony Brook are from the bottom fifth compared with 4% at the Ivy-Plus colleges, Stony Brook has a bottom-to-top-fifth mobility rate of 8.4%, substantially higher than the 2.2% rate on average at Ivy-Plus colleges.

The colleges that have the highest upward mobility rates, listed in the table below, are typically mid-tier public schools that have many low-income students and very good outcomes.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Name</th>
<th>Mobility Rate</th>
<th>Access</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cal State University – LA</td>
<td>9.9%</td>
<td>33.1%</td>
<td>29.9%</td>
</tr>
<tr>
<td>2</td>
<td>Pace University – New York</td>
<td>8.4%</td>
<td>15.2%</td>
<td>55.6%</td>
</tr>
<tr>
<td>3</td>
<td>SUNY – Stony Brook</td>
<td>8.4%</td>
<td>16.4%</td>
<td>51.2%</td>
</tr>
<tr>
<td>4</td>
<td>Technical Career Institutes</td>
<td>8.0%</td>
<td>40.3%</td>
<td>19.8%</td>
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<tr>
<td>5</td>
<td>University of Texas – Pan American</td>
<td>7.6%</td>
<td>38.7%</td>
<td>19.8%</td>
</tr>
<tr>
<td>6</td>
<td>City Univ. of New York System</td>
<td>7.2%</td>
<td>28.7%</td>
<td>25.2%</td>
</tr>
<tr>
<td>7</td>
<td>Glendale Community College</td>
<td>7.1%</td>
<td>32.4%</td>
<td>21.9%</td>
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<tr>
<td>8</td>
<td>South Texas College</td>
<td>6.9%</td>
<td>52.4%</td>
<td>13.2%</td>
</tr>
<tr>
<td>9</td>
<td>Cal State Polytechnic – Pomona</td>
<td>6.8%</td>
<td>14.9%</td>
<td>45.8%</td>
</tr>
<tr>
<td>10</td>
<td>University of Texas – El Paso</td>
<td>6.8%</td>
<td>28.0%</td>
<td>24.4%</td>
</tr>
</tbody>
</table>

*Note: Table lists highest-mobility-rate colleges with more than 300 students per cohort.*
The differences in mobility rates across colleges are not driven by differences in the distribution of college majors or other institutional characteristics. The estimates are similar when we measure children's income at the household instead of individual level or adjust for differences in local costs of living.

If we measure “success” in earnings as reaching the top 1% of the income distribution instead of the top 20%, we find very different patterns. The colleges that channel the most children from low- or middle-income families to the top 1% are almost exclusively highly selective institutions, such as UC-Berkeley and the Ivy-Plus colleges, where 13% of students from the bottom fifth reach the top 1%. No college in the U.S. currently offers a high rate of upper-tail (top 1%) success while providing very high levels of access to low-income students.

4. Trends

Finally, we examine how access and mobility rates have changed since 2000, when our data begin. Despite substantial tuition reductions and other outreach policies, the fraction of students from low-income families at the Ivy-Plus colleges increased very little across a range of income percentiles (e.g., below the 20th, 40th, or 60th percentile). This is illustrated by the trend in the fraction of students from the bottom quintile at Harvard in the figure below. This result does not imply that the increases in financial aid had no effect on access; absent these changes, the fraction of low-income students might have fallen, especially given that real incomes of low-income families fell due to widening inequality during the 2000s.

Trends in Low-Income Access from 2000-2011 at Selected Colleges

The increase in our percentile-based measures of access at elite private colleges is smaller than suggested by the increase in the fraction of students receiving federal Pell grants—a widely-used proxy for low-income access—because the Pell eligibility threshold rose in the 2000s and the real income.

Meanwhile, access at institutions with the highest mobility rates (e.g., SUNY-Stony Brook and Glendale Community College in the figure above) fell sharply over the 2000s, perhaps because...
REFERENCES

Worth Publishers, Chapter 11


