Risk-Based Student Loans

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Cleveland, OH
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10:40-12:10PM
Risk-based student loans

- Policy goals of the federal student loan program
- Human capital theory and the economic value of education
- Some degrees have higher economic value than others
- Market failures in higher education and skills mismatch in the labor market
- Risk-based pricing as a solution
NDEA and HEA created student loans to serve economic policy goals

- Develop a skilled labor force to serve the needs of business and government
- Promote equality of opportunity and individual economic advancement
- Promote technological development and economic growth

Note: Similar goals have been expressed in other Federal legislation supporting higher education:

- Morrill Act (1862, Land Grants) required “mechanical and agricultural arts” be taught
- National Defense Education Act of 1958 focused on STEM
- Higher Education Act of 1965 (NDEA, plus emphasis on social mobility)
Federal student loans are an increasingly important source of education financing

Full-time, full-year undergraduates receiving federal student loans, 1993-2008
Percent of undergraduates, by type of institution

Source: National Center for Education Statistics, Digest of Education Statistics 2011, Table 358; Digest of Education Statistics 2008, Table 340
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Educated workers earn more and are unemployed less

**Educational attainment and unemployment, 2012**

*Percent unemployed*

- Professional Degree: 2.1%
- Doctoral Degree: 2.5%
- Master’s Degree: 3.5%
- Bachelor’s Degree: 4.5%
- Associate’s Degree: 6.2%
- Some college, no degree: 7.7%
- High school diploma: 8.3%
- Less than high school diploma: 12.4%

**Educational attainment and median weekly earnings, 2012 USD**

- Professional Degree: $1,735
- Doctoral Degree: $1,624
- Master’s Degree: $1,300
- Bachelor’s Degree: $1,066
- Associate’s Degree: $785
- Some college, no degree: $727
- High school diploma: $652
- Less than high school diploma: $471

Note: Workers age 25 and older only
Decades of data show that educated workers are less likely to be unemployed.

Average annual unemployment rates, age 25 or older, 1992-2012
Percent of workers age 25 or older who were unemployed

Decades of data show that educated workers earn more, and the wage premium has increased over the last 30 years.

Median usual weekly earnings of full-time workers 25 years and over by educational attainment, 1979-2012

Real 2012 USD

Education boosts wages after controlling for student ability

Economists’ estimates of increase in wages caused by one year of schooling

Percent increase in lifetime wages from an additional year of school, midpoint estimate

<table>
<thead>
<tr>
<th>Study</th>
<th>Estimated Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOR, Raaum &amp; Aabo (2000)</td>
<td>6%</td>
</tr>
<tr>
<td>AUS, Miller, et al. (1995)</td>
<td>7%</td>
</tr>
<tr>
<td>GBR, Bonjour et al. (2003)</td>
<td>8%</td>
</tr>
<tr>
<td>USA, Kreuger &amp; Lindahl (1998)</td>
<td>9%</td>
</tr>
<tr>
<td>USA, Rouse (1998)</td>
<td>10%</td>
</tr>
<tr>
<td>USA, Becker (1994)</td>
<td>11%</td>
</tr>
<tr>
<td>USA, Taubman &amp; Wales (1973)</td>
<td>12%</td>
</tr>
<tr>
<td>GBR, Harmon &amp; Walker (1995)</td>
<td>14%</td>
</tr>
<tr>
<td>Ex-U.S. Average</td>
<td>9.2%</td>
</tr>
<tr>
<td>U.S. Average</td>
<td>11.8%</td>
</tr>
</tbody>
</table>
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Some academic majors have a higher initial labor market value than others

Recent graduates’ median starting salary offer by major, 2011
2011 USD thousands

Source: National Association of Colleges and Employers, The Class of 2011 Student Survey Report 36 Figure 30
Note: Bachelor’s degree recipients only
Some academic majors are more likely to lead to employment at graduation than others

Job offer rate by major, 2011
Percent of recent graduates with job offers at graduation

Source: National Association of Colleges and Employers, The Class of 2011 Student Survey Report 34 Figure 28
Some academic majors have a higher labor market value than others

<table>
<thead>
<tr>
<th>Job offer rate by major, 2011</th>
<th>Recent graduates' median starting salary offer by major, 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of recent graduates with job offers at graduation</td>
<td>2011 USD</td>
</tr>
<tr>
<td>56.2%</td>
<td>Computer Science</td>
</tr>
<tr>
<td>53.8%</td>
<td>Accounting</td>
</tr>
<tr>
<td>50.9%</td>
<td>Economics</td>
</tr>
<tr>
<td>50.0%</td>
<td>Engineering</td>
</tr>
<tr>
<td>46.3%</td>
<td>Business Administration</td>
</tr>
<tr>
<td>41.7%</td>
<td>Mathematics</td>
</tr>
<tr>
<td>38.9%</td>
<td>Sociology</td>
</tr>
<tr>
<td>37.9%</td>
<td>Psychology</td>
</tr>
<tr>
<td>37.6%</td>
<td>Communications</td>
</tr>
<tr>
<td>36.2%</td>
<td>Liberal Arts/Humanities</td>
</tr>
<tr>
<td>35.3%</td>
<td>Biology</td>
</tr>
<tr>
<td>34.3%</td>
<td>Visual &amp; Performing Arts</td>
</tr>
<tr>
<td>33.8%</td>
<td>History/Political Science</td>
</tr>
<tr>
<td>28.7%</td>
<td>Healthcare</td>
</tr>
<tr>
<td>23.5%</td>
<td>English</td>
</tr>
<tr>
<td>19.5%</td>
<td>Education</td>
</tr>
</tbody>
</table>

Source: National Association of Colleges and Employers, The Class of 2011 Student Survey Report 36 Figure 30, Report 34 Figure 28
Past starting salary for graduates with a certain major is a reasonably good predictor of future starting salaries by major.

Median salary one year after graduation by major for 2000 and 2008 graduates
2011 USD Thousands

First year salary for workers who received their bachelor's degree in 2008 vs. 2000 regression line

\[
[\text{salary}_{2008}] = 0.93[\text{salary}_{2000}] - 898
\]

\[ R^2 = 0.85 \]

Source: National Center for Education Statistics, Digest of Education Statistics 2011, Table 404
Note: Bachelor's degree recipients only
Over the long term, college graduates in some fields earn more and are more likely to work full time.

Annualized median earnings by bachelor degree field, 2009
Population age 18 and over where highest degree is bachelor's
2011 USD thousands

Source: US Census Bureau, Survey of Income and Program Participation, 2008 Panel, Table 4G.
Note: Bachelor's degree recipients only; annualized earnings calculated by multiplying monthly earnings by 12.
Some majors may provide better opportunities to boost earnings with additional work experience or graduate education.

Median earnings by college major, age, and education attainment 2009-2010

Real 2011 USD thousands

- Graduate Degree Holder (age 30-54)
- Experienced College Graduate (age 30-54)
- Recent College Graduate (age 22-26)

The most valuable graduate degree fields are medicine, computers, engineering, law, and business.

Annualized median earnings by advanced degree field, 2009
Population age 18 and over where highest degree is an advanced degree
2011 USD thousands

Source: US Census Bureau, Survey of Income and Program Participation, 2008 Panel, Table 4H.
Note: Annualized earnings calculated by multiplying monthly earnings by 12.
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In spite of high wages and strong employment prospects, the U.S. produces relatively few STEM degrees.

### STEM college degrees as percent of total by country, 2008

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent of total college graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>33%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>33%</td>
</tr>
<tr>
<td>Germany</td>
<td>29%</td>
</tr>
<tr>
<td>France</td>
<td>27%</td>
</tr>
<tr>
<td>Austria</td>
<td>27%</td>
</tr>
<tr>
<td>Finland</td>
<td>27%</td>
</tr>
<tr>
<td>Japan</td>
<td>24%</td>
</tr>
<tr>
<td>Sweden</td>
<td>23%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>22%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>22%</td>
</tr>
<tr>
<td>Italy</td>
<td>20%</td>
</tr>
<tr>
<td>Canada</td>
<td>20%</td>
</tr>
<tr>
<td>Ireland</td>
<td>19%</td>
</tr>
<tr>
<td>Belgium</td>
<td>19%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>15%</td>
</tr>
<tr>
<td>Denmark</td>
<td>15%</td>
</tr>
<tr>
<td>Australia</td>
<td>14%</td>
</tr>
<tr>
<td>Norway</td>
<td>14%</td>
</tr>
<tr>
<td>United States</td>
<td>14%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>14%</td>
</tr>
<tr>
<td>Iceland</td>
<td>14%</td>
</tr>
</tbody>
</table>

Source: Organization for Economic Cooperation and Development, Graduates by Field of Education
Differences in earnings by major do not appear to be due solely to differences in student ability.

2011 median starting salary offer and 2007 mean SAT score by college major


Note: Differences in SAT scores may be underestimated because SAT scores are for intended majors and salaries are for completed majors. There is some evidence that lower ability students switch from challenging majors such as Engineering and Computer Science into less challenging majors such as Business, English, and other social science and humanities fields.
Differences in earnings by major do not appear to be due solely to differences in student ability

Average SAT scores of high school seniors by intended college major, 2005-2008

Many students who currently choose lower value fields have the ability to succeed in business

Percent of GRE test takers who have quantitative GRE scores that are above the average scores of students who intend to study business in graduate school, by intended graduate major, Aug. 2011 - Apr. 2012

Percent of students with high quantitative GRE scores

Note: Most graduate business students take the GMAT rather than the GRE. Those taking the GRE may intend to pursue a Ph.D. in business rather than an MBA.
Source: Educational Testing Service, GRE Guide to the Use of Scores (2012), Table 4
Many students who currently choose lower value fields have the ability to succeed in engineering.

Percent of GRE test takers who have quantitative GRE scores that are above the average scores of students who intend to study engineering in graduate school, by intended graduate major, Aug. 2011 - Apr. 2012

Percent of students with high quantitative GRE scores

Source: Educational Testing Service, GRE Guide to the Use of Scores (2012), Table 4
Students who take courses in high value fields receive lower grades, especially in the early years of college when they select a major.

Grades by course type and school year for a sample of Duke undergraduates

Non-cumulative within-year grade point average,

Lower STEM grades cannot be explained by ability levels: Students in high value fields have higher test scores

SAT scores by pre-college intended major and completed major for a sample of Duke undergraduates

Lower STEM grades cannot be explained by effort:
Students in high value fields study more

Percent of full time seniors who spend more than 20 hours
per week preparing for class, by major

- Engineering: 42%
- Physical sciences: 36%
- Biological sciences: 34%
- Arts & humanities: 31%
- Education: 26%
- Social sciences: 23%
- Business: 19%

Hours per week spent preparing for class by full time
college seniors, by major

- Engineering: 19 hours
- Physical sciences: 18 hours
- Biological sciences: 17 hours
- Arts & humanities: 17 hours
- Education: 15 hours
- Social sciences: 14 hours
- Business: 14 hours

Source: Indiana University Center for Postsecondary Research, National Survey of Student Engagement 15 (2011) Figure 7, 8
Students who initially intend to major in high value STEM fields switch to less demanding fields prior to graduation

Percent of bachelors degrees conferred each year versus percent of college-bound students who intended to major in field four years earlier

Source: College Board; National Center For Education Statistics
Workers with undergraduate degrees in some fields with low starting salaries (but high grades) are likely to attend law school or medical school.

Propensity for Pursuing Professional Degrees by Undergraduate Major
Percent of workers aged 35 to 55 from the 1993 National Survey of College Graduates

Workers with undergraduate degrees in some fields with low staring salaries are likely to attend law school or medical school

Propensity for Pursuing Professional Degrees by Undergraduate Major, 2009
Percent of college graduates aged 18 and over with professional degree

Note: Preprofessional majors, not shown, have the highest rates of professional school attendance, at 23.4% law degrees and 26.8% medical degrees.
Among those with a law degree, workers with high value undergraduate degrees earn the most

Earnings of workers with a law degree, by undergraduate major
*Earnings as a percent of earnings for economics majors, workers aged 35 to 55

Economics: 100.0%
Finance*: 91.2%
Accounting*: 90.6%
Political science: 85.2%
History: 83.8%
English: 83.1%
Psychology: 83.0%
Criminology: 79.7%
Business administration: 76.1%
Philosophy & theology: 69.9%
Sociology: 64.5%

Note: * No statistically significant difference compared to economics majors. Foreign language not statistically significant and not shown.
MBAs with high value undergraduate majors generally earn more than MBAs with low value undergraduate majors

Earnings of workers with a master's degree in business, by undergraduate major

Earnings as a percent of earnings for economics majors, workers aged 35 to 55


Note: * No statistically significant difference compared to economics majors.
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Basic features of risk based pricing

- Data-driven pricing of interest rates on loans
  - Focus on historic data
  - Limited use of forecasting based on anticipated demand and supply

- Focus on factors that are under students’ control
  - Choice of major (measured by course completions not declarations)
  - Choice of geographic location of school
  - Ability (?)

- Increase labor market transparency
  - Before students even arrive on campus through institutional rates
  - Each semester, pricing for new loans based on latest labor market data
  - Clear, comprehensible, salient disclosures to students

- Certain predictors can be excluded for ethical or moral reasons
  - race
  - parental wealth or income
  - Ability (?)
Theoretical advantages of risk based pricing

- Universities shift resources toward fields that are most in demand, esp. STEM
- Increased employment
- Increased wages
- Better skills matching
- Wage compression and increased socioeconomic mobility
- Increased tax revenue and reduced burdens on social services
- Higher levels of technical and mathematical skill, economy wide
Risk-based pricing would incorporate prevailing interest rates, the probability of default and the loss given default into loan pricing.

Simplified risk based pricing equation:

- Risk-based loan interest rate
  - Credit spread
    - Probability of default
    - Loss given default
  - Risk-free rate (duration-matched US treasuries)

Note that credit spreads can be driven either by likelihood or severity of default.
Risk-based pricing would incorporate prevailing interest rates, the probability of default and the loss given default into loan pricing.

Slightly less simplified risk based pricing equation:

\[ x = \frac{1 + g}{1 - (D \times L)} - 1 \]

- Risk based loan interest rate to break even
- Annual probability of default
- Loss given default
- Risk-free interest rate
- Simplifying assumptions:
  - Lender is risk neutral
  - Lender not subject to liquidity risk
  - Lender can borrow at risk free rate
  - No administrative costs