

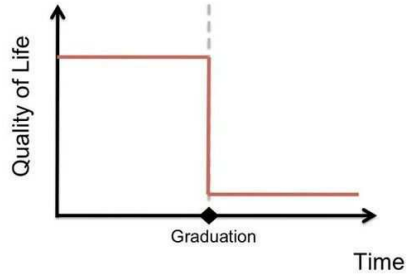
# **Everything you wanted to know about college major choice**

Prof. Tyler Ransom

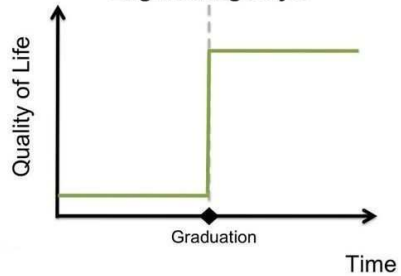
University of Oklahoma, Dept. of Economics

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### Liberal Arts Major



### Engineering Major



WHILE PRE-MED GIVES  
YOU TWITCHY-EYED  
OBSESSION WITH YOUR GPA,



a  
poetry degree  
bespeaks  
bewildering  
naïveté.



TV'S BEHIND THE  
RUSH INTO FORENSIC  
CRIMINOLOGY

CSI:  
MIAMI

(OR SO CLAIMS  
META-ACADEMIC  
EPIDEMIOLOGY).



BY DUBBING ECON  
"DISMAL SCIENCE"  
ADHERENTS EXAGGERATE;



THE "DISMAL'S FINE—IT'S  
"SCIENCE" WHERE THEY  
PATENTLY PREVARICATE.



IN TERMS OF CHOICES,  
I'D SAY ONLY SOPHIE'S  
WAS COMPARABLE.



JUST PUT ME DOWN AS  
"UNDECIDED"—EVERY  
MAJOR'S TERRIBLE!



# Outline

## 1. Why Majors?

## 2. Selection

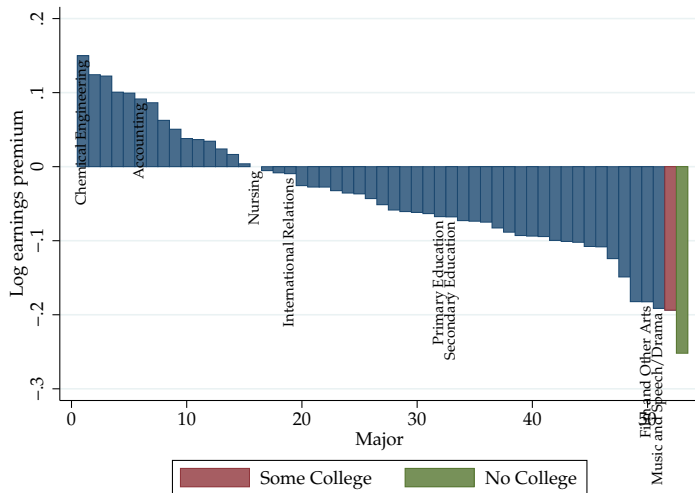
## 3. Universities

## 4. Women & Minorities in STEM

## Why do we care about college major?

- ▶ According to Altonji, Arcidiacono, and Maurel (2016):
- ▶ Education is no longer unidimensional
- ▶  $\Rightarrow$  returns to *type* of schooling  $>$  returns to *amount* of schooling
- ▶ Huge differences in labor market outcomes across majors

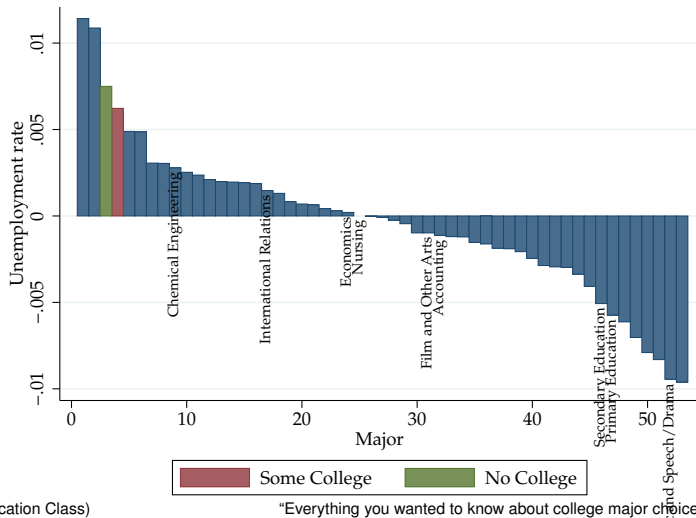
# Earnings

[Data details](#)

## Earnings (cont'd)

Rank	Major	Earnings (relative to nursing)
1	Chem Engineering	0.150
2	Elec Engineering	0.124
3	Economics	0.122
4	Mech Engineering	0.101
5	Finance	0.099
⋮	⋮	⋮
49	Philosophy and Religion	-0.182
50	Film and Other Arts	-0.182
51	Music and Speech/Drama	-0.191
52	Some college	-0.194
53	No college	-0.252

# Unemployment

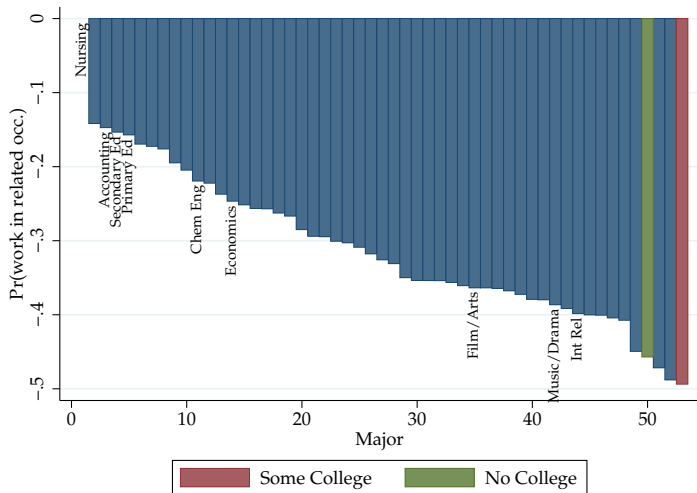




## Unemployment (cont'd)

Rank	Major	Unemp. Rate (rel. nursing)
1	Computer Programming	0.011
2	Public Admin and Law	0.011
3	No college	0.007
4	Some college	0.006
5	Physics	0.005
⋮	⋮	⋮
49	Journalism	-0.007
50	Agriculture and Agr. Sci	-0.008
51	Family and Consumer Sci	-0.008
52	Music & Speech/Drama	-0.009
53	Leisure Studies	-0.010

## Work in a related occupation



## Related occupation employment (cont'd)

Rank	Major	Rel. Occ. Emp. Rate (rel. nursing)
1	Nursing	0.000
2	Civil Engineering	-0.142
3	Accounting	-0.147
4	Secondary Educ.	-0.153
5	Primary Educ.	-0.157
⋮	⋮	⋮
49	Agriculture and Agr. Sci	-0.449
50	No college	-0.457
51	General Science	-0.472
52	Environmental Studies	-0.488
53	Some college	-0.494

## Aggregate economic output

- ▶ STEM majors are thought to produce more innovation than others
- ▶ If US doesn't produce enough STEM majors, economic growth may suffer due to decreased innovation

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## What can explain these large differences?

- 1 True treatment effect (✓ human capital vs. signaling)
  - ▶ i.e. anyone randomly assigned to be an engineering major will earn more than if they hadn't
- 2 Unobserved ability bias
  - ▶ engineering majors would have earned just as much if they were drama majors
- 3 Comparative advantage (✓ Roy model)
  - ▶ drama majors would have earned *even less* if they were engineering majors, because they lack appropriate skills

## Explanations (cont'd)

### 4 Preferences

- ▶ Compensating differentials: high-paying majors worse in other aspects
  - ▶ More difficult coursework during college (see [xkcd.com/863/](http://xkcd.com/863/))
  - ▶ More unpleasant jobs / higher unemp. risk after college
  - ▶ **Even if ability is same across majors, this could generate earnings differences**
- ▶ parental approval
  - ▶ parents won't help pay for college if certain majors are chosen

### 5 Occupation after college

- ▶ Choice of major may limit later occupational choices
- ▶ Majors with higher earnings may indicate greater access to occupations with higher earnings

### 6 Information

- ▶ students are misinformed about major-specific outcomes

## Difficulties in uncovering causal effects

- ▶ Need to know the counterfactual outcomes for each person/group
  - ▶ i.e. what would my earnings have been if I had chosen business instead of humanities?
- ▶ Counterfactual complicated by link between occupation and major
  - ▶ i.e. what occupation would I be working in if I had chosen business instead of humanities?
- ▶ Different students place different weight on study effort during college, wages & jobs after college, etc.
  - ▶ So even if we knew the causal effect on earnings and occupation, we may not know the student's taste for other job attributes



## Overcoming selection biases

Ways that have been used to uncover the labor market return to majors:

- ① Assume unconfoundedness (James et al., 1989; Altonji, 1993; Webber, 2014, many others)
  - ▶ OLS regression of log earnings on major dummies + other controls
  - ▶ Various attempts to account for cognitive/non-cognitive abilities, selection bias, college quality
- ② Model preferences (Arcidiacono, 2004; Beffy, Fougère, and Maurel, 2012; Kinsler and Pavan, 2015)
  - ▶ Use students' choices to back out how much they prefer good grades vs. high earnings, etc.
  - ▶ Can say how much of wage premium is selection vs. actual returns

## Overcoming selection biases (Cont'd)

- ③ Elicit beliefs from students (Arcidiacono, Hotz, and Kang, 2012; Arcidiacono et al., 2014; Wiswall and Zafar, 2015, many others)
  - ▶ Ask students how likely they would choose a given major under various counterfactual scenarios
  - ▶ Able to uncover preference intensity for each major
- ④ Fuzzy RD (non-US settings; see Hastings, Neilson, and Zimmerman, 2013; Kirkeboen, Leuven, and Mogstad, 2016)
  - ▶ Leverage random variation in major choice induced by test score cutoffs
  - ▶ Can uncover LATE associated with particular major

## Evidence on wage returns to major

- ▶ There is a causal effect of major choice on earnings (Kirkeboen, Leuven, and Mogstad, 2016)
- ▶ Casual effect is smaller than raw premium (due to unobserved ability bias)
- ▶ Large variance in earnings even within major (Webber, 2014)
  - ▶ see [http://www.hamiltonproject.org/charts/career\\_earnings\\_by\\_college](http://www.hamiltonproject.org/charts/career_earnings_by_college)

## College major vs. college quality

- ▶ Returns to college major appear to trump returns to college quality (James et al., 1989; Kirkeboen, Leuven, and Mogstad, 2016)
  - ▶ but not necessarily in Chile (Hastings, Neilson, and Zimmerman, 2013)

## Evidence on comparative advantage

- ▶ Students appear to sort into majors based on comparative advantage
  - ▶ true for academic ability (Arcidiacono, Hotz, and Kang, 2012; Arcidiacono et al., 2016; Kirkeboen, Leuven, and Mogstad, 2016)
  - ▶ also true for occupation ability (Kinsler and Pavan, 2015)

## Evidence on preferences

- ▶ Students choose major in part due to lower study effort during college (Arcidiacono et al., 2016; Ahn et al., 2017)
- ▶ Students care about future wages when choosing major (Arcidiacono, 2004; Beffy, Fougère, and Maurel, 2012; Wiswall and Zafar, 2015)
- ▶ But care more about non-wage attributes of the major (Wiswall and Zafar, 2015)
- ▶ Preferences for occupation & future job also matter a lot, and are heterogeneous (Arcidiacono et al., 2014; Wiswall and Zafar, Forthcoming)

## Evidence on Information frictions

- ▶ Students are misinformed about earnings across majors in the population (Wiswall and Zafar, 2015)
- ▶ Students would switch their major if they knew with certainty what their ability is (Arcidiacono, Hotz, and Kang, 2012; Arcidiacono et al., 2016)

## Take-home message

When choosing a major, students should ask themselves:

- ☐ Do I know the future career path of students graduating in this field?
- ☐ Can I get good grades in this field?
- ☐ Do I like studying this field?
- ☐ Can I make a decent living at jobs in this field?
- ☐ Would I like working in jobs related to this field?
- ☐ Is this field my comparative advantage?

It may not be possible to check all boxes, but should be possible to find a major that checks most



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## The role of universities on major choice

*[Our] purpose is to encourage undergraduates to follow their intellectual passions and study what they love, with confidence in the fulfilling lives that lie ahead and the knowledge that **in no way will their choice of major limit the career choices they may wish to make in the future.***

*(Princeton University — Major Choices vol. II (emphasis mine))*

- ▶ Universities may want to steer students to certain majors:
  - ▶ To match the number of faculty in each field
  - ▶ To match the costs of instruction in each field (Altonji and Zimmerman, 2017)
- ▶ Not a lot of research on this topic

## Main findings (Altonji and Zimmerman, 2017)

- ▶ Large differences in costs of producing majors (engineering is expensive, business is cheap)
- ▶ Also large differences in costs of producing, net of labor market returns of graduates
- ▶ Universities don't appear to make spending changes in response to per-credit production costs, or in response to earnings

## Admissions policies

- ▶ Affirmative action policies at the university level can change the composition of student preparedness and hence the composition of STEM majors (Arcidiacono, Aucejo, and Spenner, 2012; Arcidiacono, Aucejo, and Hotz, 2016)
- ▶ Less prepared minority students at Berkeley/UCLA would have higher science graduation rates had they attended UC Santa Cruz/Riverside (Arcidiacono, Aucejo, and Hotz, 2016)

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## Women in STEM

- ▶ Women don't choose STEM because they have different pre-college skill composition (Aucejo and James, 2017; Speer, 2017)
  - ▶ Men show more STEM skills in early high school (Speer, 2017); Women more verbal skills (Aucejo and James, 2017)
- ▶ HS course curriculum and gender gap in college enrollment (Card and Payne, 2017)
  - ▶ Consistent with comparative advantage: the men who go to college are STEM-ready, whereas only some of the women who go to college are STEM-ready.
- ▶ Some evidence that harsher grading in STEM fields may contribute to gap because women prefer good grades (Ahn et al., 2017)
- ▶ Mixed evidence that same-gender professors are a factor (Griffith, 2010; Price, 2010)

## Minorities in STEM

- ▶ Affirmative action can have large effects (Arcidiacono, Aucejo, and Spenner, 2012; Arcidiacono, Aucejo, and Hotz, 2016)
- ▶ Same-race professors (Price, 2010) or graduate students (Griffith, 2010) can improve STEM retention among minorities

## Data details

- ▶ 22-55 yr olds, HS grad or above, 2009-2015 American Community Survey ( $N \approx 6$  million)
- ▶ Each bar is one of 51 majors, or “some college” or “no college”
- ▶ Right-hand side variables:
  - ▶ major dummies (incl. no college & some college as “majors”)
  - ▶ calendar year dummies
  - ▶ advanced degree dummy
    - ▶ calendar year, gender, foreign born, marital status, race/ethnicity dummies
    - ▶ cubic in age
  - ▶ industry, occupation, residence state dummies
- ▶ Restrict to annual earnings between \$20k-\$600k



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