# **Connecting Higher Education to Workplace Activities and Earnings**

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## Institutions of Higher Education are a Major Source of Skills

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#### **Research Questions:**

- 1. What specific skills do universities impart on students?
- 2. How do these skills affect graduate earnings?

Measure what is being taught through syllabi from hundreds of U.S. universities

• Theoretically, syllabi provide, at the class level, what skills a student should obtain from the class

Compare the learning objectives in the syllabi to O\*NET's detailed work activities (DWAs)

- DWAs: Readily available, widely accepted measure of skills necessary for an occupation
- Compare using natural language processing (NLP) methods

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• Median earnings for the year immediately following graduation by university and field of study for 2016 and 2017 graduates

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#### Integrated Postsecondary Education Data System (IPEDS)

• Geography and institutional characteristics for sample selection

## How to Measure the Relationship Between Syllabi and DWAs? Approach

Word embeddings applied to both the syllabi and O\*NET DWAs

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Relationship between a syllabus s and a DWA by comparing their word embedding vector representations with a soft cosine measure – between 0 and 1

- One for each DWA  $\rightarrow$  2070 dimension for each syllabus



2070 x 1 vector built based on cosine similarity for each syllabus



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Α				
	Engineering	Bu	isiness	
research advanced e <mark>ngineering designs or applicati</mark>		develop financial or business plans.		
design electrical equipment or systems.		analyze business or financial data.		
design alternative energy systems.		identify strategic business investment opportuniti		
design control system <mark>s for mechanic</mark>	advise others on business or operational matters.			
design industrial pro	cessing systems.	prepare busine	ess corresponde	ence.
design integrated co	omputer systems.	manage financ	ial activities of	the organization.
design energy-efficien <mark>t vehicles or v</mark>	vehicle compon	develop busine	ess relationship	s.
design systems <mark>to reduce h</mark>	armful emissions.	assess risks to	business opera	ations.
design en <mark>vironmental control systems.</mark> maintain knowledge of business operations.				ess operations.
desig <mark>n civil structures or systems.</mark> monitor business indicators.				
design electromecha <mark>nical equip</mark>	ment or systems.	maintain recor	ds of sales or o	ther business transa
design industrial equipment. establish business management methods.				ent methods.
design energy-effi <mark>cient equip</mark>	ment or systems.	monitor extern	al affairs or eve	ents affecting busin
design water conservation systems.		confer with personnel to coordinate business opera		
design micro- or nano-s <mark>cale mater</mark>	ials, devices, or	direct financial	l operations.	
-0.2 -0.	1 0	.0	0.1	0.2
DWA contribution to difference				



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Combine syllabus data with College Scorecard measures of median earnings the year after graduation

- Each observation is at the field of study x institution level
- Sample selection: minimum 10 syllabi
- Ideally, we would be estimating a fixed effects regression model
  - Hopefully, we will have a longer panel of earnings data in the future
- Assumption: Syllabi are representative of what students learn

### Do Detected DWAs Predict Graduate Earnings?

Regress DWAs from syllabi on earnings the first year following graduation

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• There are a lot of DWAs and we are concerned about overfitting

Regress Use LASSO and cross-validation to select DWAs from syllabi and assess their effect on earnings the first year following graduation

- Penalizes having too many DWAs
- Estimates the effect out-of-sample
  - Makes it a predictive exercise

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Compare this estimate to the predictive power of

- Field of Study (major)
- University rank
- Geography

Outcome:  $R^2$ 





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Future work

- How do skills taught affect workers' career paths?
  - Resume data include field of study and graduation year, providing a basis for combining skills with eventual job outcomes

Any feedback is appreciated!

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