Effects of Entry Economic Conditions on the Career of Economics Ph.D.

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Introduction

There is no unemployment among Ph.D.s in economics

– John Siegfried

- Strong demand for economics PhD over the decade (BLS 2021)
  - growing demand both in academia and in practice
  - industries appreciate causal inferences more and more (Athey, Luca 2019)
- Pandemic left scars on the current economics profession worldwide (INOMICS) and lowered demand for entry worker (JOE)
  - 2020's Jobs for economists have 14% fewer job postings than 2019
- Bad labor market conditions at the entry have large and persistent negative effects on careers in general (Kahn 2010, Oreopoulos et al. 2012)
- Less work has been done on whether the careers of economists is affected by the business cycles
- I build a theoretical model to examine how the entry condition would affect economists' productivity and test the predictions empirically

Features of the Market for Ph.D.s in Economics

- Centralized matching systems and require advanced degrees
- Different workplace environment
  - academics: work under up-or-out policies
  - private sectors: high skilled industries
  - little is known for switching patterns among the occupations
- More than half of graduates are internationals (proxied by bachelor degree abroad vs US degree)
- Low unemployment, but the placement outcomes varies by economic conditions
- Detailed employment histories and some objective measures of research are available

Motivation and Research Question

- Workers graduating into a recession would likely match to a lower level starting jobs than their luckier counterparts (Devereux 2002)
  - first job placement is important in explaining the long-term losses (Kwon et al 2010, Oreopoulos et al. 2012)
  - how long the effects remain depends on the ease of switching jobs (Van den Berge 2018, Cockx and Ghirelli 2016)
- Set up the theoretical model to explain what drives the persistent outcomes for economics PhD
- Test the model's predictions using detailed information on career paths and productivity measures available on the web
  - short run: initial placements
  - long run: occupational choices and publications

Preview: Findings

- Demand for economists is procyclical
  - fluctuations are primarily driven by the academic tenure-track positions in the US
- Entry conditions would affect the initial placement outcomes
  - recessionary cohorts are less likely placed in tenure-track academic positions in US
- Recessionary cohorts are
  - less likely to work in academia in the long run
  - publish fewer top 50 journal publications
  - more likely to switch firms
  - not any more likely to switch occupations
- The model provides the testable hypothesis on the transferability of the labor market skills for economists
  - findings support task-specific human capital approach and the occupations are specialized

Road Map

1. Literature Review
2. Data
3. Theoretical Model
4. Empirical Results
5. Conclusion

Contribution I : Persistent effects of Entry condition

- Many papers analyze the effect of entry conditions on the labor market outcomes overtime (Kahn 2010, Oreopoulos et al. 2012, Schwandt and von Wachter 2019, Yu et al. 2014, Maclean, 2015, Ball 2021)
  - earnings, labor supply, health, family formation, crimes
  - effects vary by education, major, race, institutional settings (Altonji et al. 2014, Beiler 2017, Choi et al. 2020, Liu et al.)
- Most relevant to mine is Oyer (2006) empirically examining economists's academic placements and publications for 7 elite schools
  - focus on cohort from 1988 to 2004 in which the private and international demand for economists different (73 % increase in private sector postings from 2004 – 2012)
  - did not examine occupation switching
    - scraping tools or data such as Linkedin profiles are not as common as this time
  - I have similar findings for R1 placements and publications and try to uncover what drives the persistent outcomes through the model

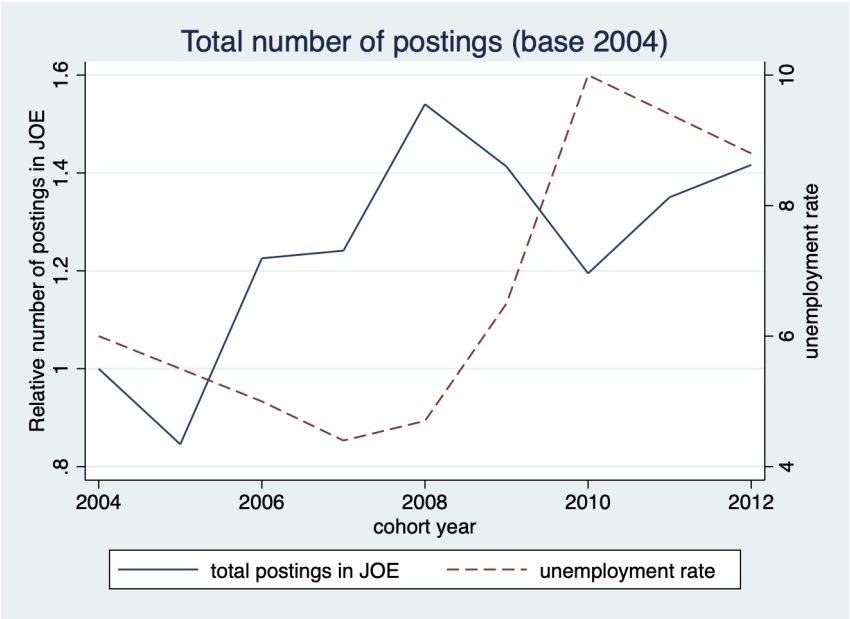
Contribution II : Occupation Choice

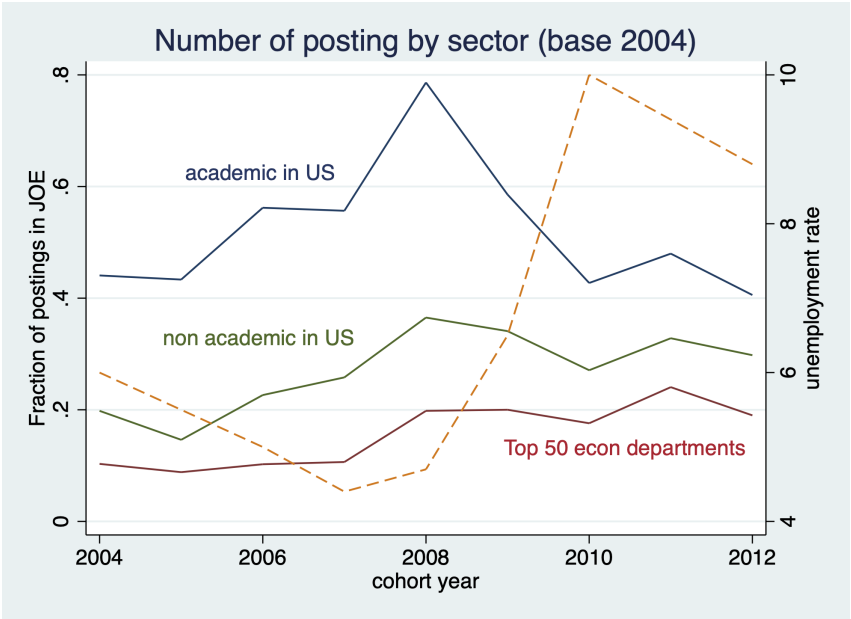
- Job mobility plays a crucial role in recovering from the early damages (Van den Berge 2018, Cockx and Ghirelli 2016)
- Human capital formation vs Signaling
  - initial investment in skills specific to occupation keeps a person on a certain career trajectory (Gibbons and Waldman 2004, 2006)
  - bad signaling from starting in a less favorable job hinders unlucky graduates to from switching occupation when recovers (Nunley et al. 2017)
- This paper provides more supporting evidence for the model of task-specific human capital and economists' mobility and how it affects outcomes in the long run
  - little evidence on signaling

Data

- ProQuest Dissertations & Theses Global
  - collect the doctoral dissertations by institutions, year of publications, economics (related) classification, subject codes
  - $\sim$ 4,600 graduates from top 32 programs in U.S. between 2004–2012
- Scrape CVs on the web or Linkedin experience profile
  - collect employment history until 2020
  - gender and post secondary education information
  - could not find about 600 individual careers
- Publication information from EconLit
- List of job postings from JOE
  - hiring institution, position, JEL classifications, job descriptions
- Construct the matching algorithm to compile all data appendix

Cyclical Demand for Economics PhD





- Total postings decreased by 22 percent between 2008–2010
  - Largest drop occurred for the U.S. academic postings (about 45 %)

Descriptive Statistics

	Overall	rank 1–10	rank 11– 23	rank 24–45
Main independent variables				
Female	0.2875	0.2512	0.3236	0.3097
US bachelor	0.4259	0.4718	0.3978	0.3765
Main outcome variables				
# of top 50 econ/finance pub in 3 year	0.3191	0.4350	0.2402	0.2044
# of top 50 econ/finance pub in 6 year	0.8475	1.1771	0.6221	0.5222
# of top 50 econ/finance pub in 9 year	1.3592	1.9008	0.9827	0.8333
Initial placements				
Tenure-track in R1 university	0.2325	0.3019	0.1843	0.1649
Private Sector	0.2413	0.2267	0.2627	0.2419
Job mobility				
switching occupations in 6 years	0.3558	0.3387	0.3609	0.3809
switching firms in 6 years	0.5991	0.5877	0.6131	0.6028
Number of Schools	32	10	10	12
Number of individuals	3,982	1,795	1,199	988

5 occupations: R1 university, all other universities in US, research organization in US, foreign institute, and private sectors

Theoretical Framework

- Human capital accumulation is largely determined during the first decade of one's career in high skill occupations (Rosen 1990, O'Flaherty and Siow 1995)
  - problem would be critical at research universities, in which tenure decisions are determined within 5-7 years
- Job mobility would raise questions on the transferability of skills
  - more costly for whose skills are not transferable across jobs
- If task-specific human capital is an integral part of the skill-acquisition process, then cohort effect could arise (Gibbons and Waldman 2006, Jin and Waldman 2019)

Task-specific Human capital

- Concept of measuring the transferability of labor market skills
  - similar to occupation(or firm) specific human capital
  - value of human capital depends on the tasks not the workplace
    - valued in occupations where similar tasks are performed
- Literature use occupational and industry codes from the census
  - change in occupation means the skills required for new occupations would be substantially different from those used in the old
  - need to build another index because of the small range of occupations economists would work at
- I define occupations into the following categories
  - R1 university defined by Carnegie Classification of Institutions of Higher Education
  - All other universities in US
  - Research organization or governmental agencies in US (e.g. World Bank, RAND)
  - Foreign institute
  - Private institute

Definition of Occupations

- Faculties in R1 university spend less time teaching compared to all other universities in US (2004 National Study of Post secondary Faculty)

	1-3 hours (%)	4-7 hours (%)	More than 7 hours (%)
Estimates			
Total	22.4	27.8	49.8
Institution: level			
2-year	18.3	23.7	58
4-year non-doctoral granting	18.6	23.5	57.9
4-year doctoral granting	27.4	33.1	39.6

- Research organization in the U.S. does not require teaching, and the research goal may not be the same as the universities
- Foreign institutes may be different from the U.S. counterparts
  - most international universities have different promotion policies from US (Smeets et al. 2006)
- Using natural language process on the job descriptions, find words related to communication and management dominantly in private sectors postings appendix

Model

- Based on the model from the Gibbons and Waldman (2004 and 2006)
- Define occupation o as the collection of firms having the same task
- A firm f assigns the combinations of tasks $\{1, ..., J\}$ to a worker.
- i produces cumulative task-task-specific output Y^j_{ifot}

$$\log Y^j_{ifot} = \sum_j \beta^j_o a^j_{iot} + \mu_{if} \quad \text{where} \quad \sum_j \beta^j_o = 1 \quad \text{for all } o = 1, ..., O \tag{1}$$

  - β^j_o is the share of time a worker spends on average in the task j in o
  - a^j_{iot}: i's productivity for task j at o and time in labor market t
  - μ_{if} denotes the match quality between i and f

Model - continue

- Productivity depends on initial endowment and experience

$$a_{iot}^{j} = \alpha_{i}^{j} + \gamma_{o} H_{it}^{j} \tag{2}$$

where

- α_{i}^{j}: initial endowment for the task j
- γ_{o}: return to human capital on occupation o
- H_{it}^{j} is the human capital accumulated in task j until time period t

$$H_{it}^{j} = \lambda_{o'}^{j} \text{Exp}_{io't} \tag{3}$$

$\text{Exp}_{io't}$ denotes the previous tenure in occupation o'

- Hence,

$$\log Y_{ifot}^{j} = \gamma_{o} \left[\sum_{j} \beta_{o}^{j} \left(\lambda_{o'}^{j} \text{Exp}_{io't} \right) \right] + \sum_{j} \beta_{o}^{j} \alpha_{i}^{j} + \mu_{if} \tag{4}$$

$$\text{where} \sum_{j} \beta_{o}^{j} = 1 \text{ for all } o = 1, ..., O$$

Model - continue

$$\log Y_{ifot}^{j} = \gamma_o \overbrace{\left[\sum_j \beta_o^j \left(\underbrace{H_{it}^j}_{\lambda_{o'}^j \text{Exp}_{io't}} \right)\right]}^{\text{Task}_{iot}} + \underbrace{\overbrace{\sum_j \beta_o^j \alpha_i^j}^{\text{m}_{io}} + \mu_{if}}_{\text{Match quality}} \tag{5}$$

$$\text{where} \sum_j \beta_o^j = 1 \text{ for all } o = 1, ..., O$$

- Task_{iot} is a measure of task-specific human capital valued by o
- m_{io} is the match quality between i and occupation o
- assume μ_{if} is random and does not develop over time
- At entry $H_{it}^j = 0$, so initial output is determined by match qualities

Incorporating Entry Condition of Business Cycle

- Impose two more assumptions to reflect the effect of economic conditions at entry

Assumption 1. most workers are research-oriented

$$\alpha_i \equiv \left(\alpha_i^1, ..., \alpha_i^J\right) \equiv m(X_i) + e_{it}, \text{ where } \alpha_i^1 \geqq \max_{j \neq 1} \alpha_i^j$$

  - $j = 1$ indicates economics-research task

- Let $\bar{t}$ and $u_{\bar{t}}$ denote the graduation year of i and economic condition at time of graduation

Theorem 1. mismatch arises during the bad times at the entry

$$\text{If } u_{\bar{t}} < u'_{\bar{t}}, \text{ then } \mathbb{E}_i\left[m_{io} \mid u_{\bar{t}}, \textstyle\sum_j H_{it}^j = 0\right] > \mathbb{E}_i\left[m_{io} \mid u'_{\bar{t}}, \textstyle\sum_j H_{it}^j = 0\right]$$

  - consistent with Bowlus (1995)

Mobility

- If i does not switch the occupation, the following corollary is derived:

Corollary 1.

If $u_{\bar{t}} < u'_{\bar{t}}$ and i did not switch o,
then $\mathbb{E}_i \left[Y^1_{ifot} \mid u_{\bar{t}}, X_i \right] > \mathbb{E}_i \left[Y^1_{ifot} \mid u'_{\bar{t}}, X_i \right]$ for all t

- The gap in productivity is driven by the two channels
  - unfavorable economic conditions result in mismatch
  - unfavorable human capitals are developed according to the tasks
- Consider how the task-specific human capital would be valued if a worker would switch occupations
  - To make an exposition simpler, examine two-task model $J = \{R, T\}$

Task Tenure with Occupational Choice

- o' and o indicate the source and target occupations, respectively

Proposition

For $\lambda^R_{o'} > 0.5$, task-tenure is valued more if moves to $\beta^R_o > \lambda^R_{o'}$

For $\lambda^R_{o'} < 0.5$, task-tenure is valued more if moves to $\beta^R_o < \lambda^R_{o'}$

For $\lambda^R_{o'} = 0.5$, task-tenure does not change regardless of moving

- How the task tenure is valued depends on the degree of specialization in the source occupation
  - one's tenure is valued more if the target occupation more specializes (close to 1) than the source occupation
  - If the source occupation is very general (close to 0.5), switching does not have any merits
- Now consider the implication for job mobility

Occupational Choice

- Suppose research oriented worker i started working at f' within teaching-heavy o' have an option to switch
  - switching entails the switching cost $x_{o't}$
- i faces

$$\max_{o',o} \left[Y_{if'o't}, Y_{ifot} - x_{o't} \right] \tag{6}$$

- Improvement on match-up qualities and returns to task tenure would make a shift more likely, but there is a loss from the task tenure according to the proposition when move

$$\begin{aligned} (m_{io} - m_{io'}) + (\mu_{if} - \mu_{if'}) + (\gamma_o - \gamma_{o'}) \, \text{Task}_{io't} \\ > \gamma_o \underbrace{\left[(\beta_{o'} - \beta_o) \left(H_{it}^R - H_{it}^T \right) \right]}_{\text{potential loss}} + \underbrace{x_{o't}}_{\text{switching cost}} \end{aligned} \tag{7}$$

Empirical prediction

$$(m_{io} - m_{io'}) + (\mu_{if} - \mu_{if'}) + (\gamma_o - \gamma_{o'})\,\text{Task}_{io't} \tag{8}$$
$$> \gamma_o \underbrace{\left[(\beta_{o'} - \beta_o)\left(H_{it}^R - H_{it}^T\right)\right]}_{\text{potential loss}} + \underbrace{x_{o't}}_{\text{switching cost}}$$

- Potential loss is governed by two factors
  - how similar the tasks between occupation o and o', $|\beta_o - \beta_{o'}|$
    - if the source occupation is very general, there would be no loss
  - how much human capital accumulated from the previous occupations

Discussion: Overview of the model's contributions

- If economists' human capital is not task-specific, the markets would be similar to the high skilled industry
  - the workers would mitigate the initial mismatch by switching, and hence the effects would not be permanent
- If workers' human capital is task specific, there are two more cases
  - the economist's tasks are specialized (distances are significant)
    - they would less likely switch because they might risk losing the human capital
    - the initial effects would remain
  - the economist's tasks are general (distances are small)
    - economists would more easily switch the occupation, and hence the initial placement effects are less likely to be permanent

Prediction I: Initial Placements

- I first test whether the entry economic conditions predict the initial placement outcomes:
  - for individual i, cohort c, department d, fields of study f

$$y_{icdf} = \beta \text{ec}_c + \gamma X_i + \lambda_d + \theta_f + \epsilon_{icdf} \tag{9}$$

  where ec_c indicates the economic conditions at graduation for c
  - approximate ec_c using the unemployment rate as of October at the one year before graduation
  - X_i includes an indicator for receiving bachelor degrees in the U.S. and gender
  - β would be unbiased as long as the average quality of economists entering the market is not systematically related to ec_c

Prediction 2: Long-run Placements

- I further test whether the entry economic conditions predict the occupational choice in the long run
  - Using the same specification (9), the dependent variable is whether one work at R1 university five and nine years after graduation
- The model predicts that the effect will remain if economists develop task-specific human capitals
- Also, if one had a higher switching cost, the effects would be stronger

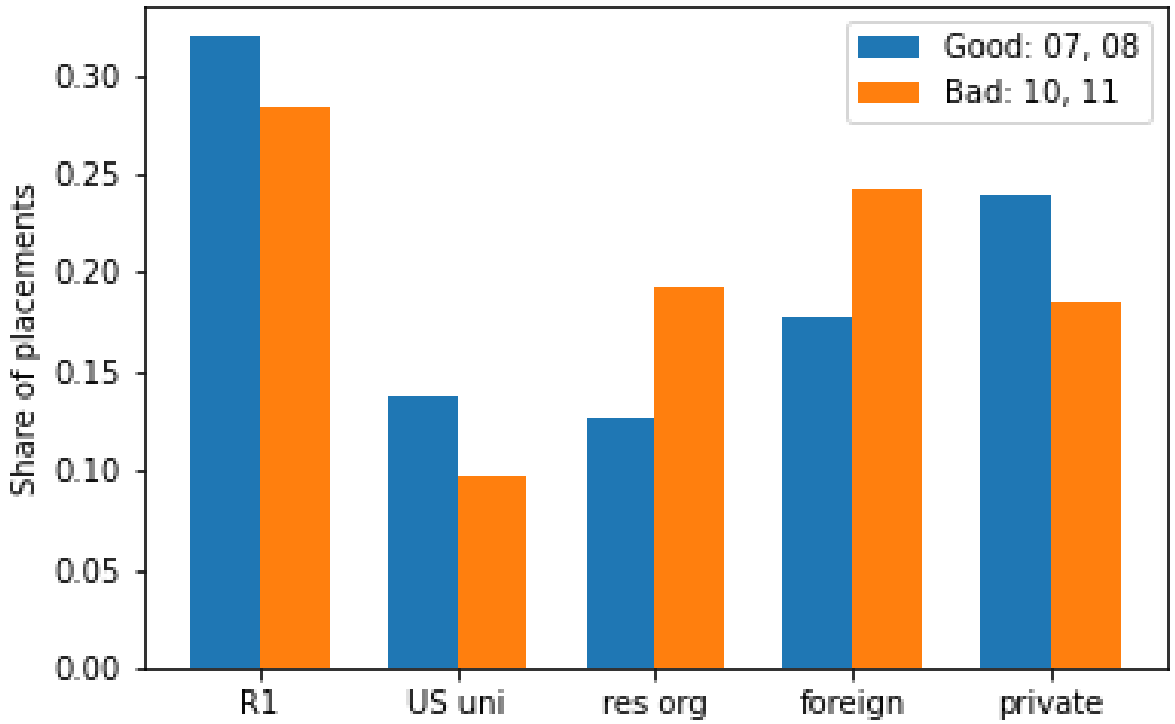
Prediction 3: Productivity

- Now I test whether the entry economic conditions would affect the economists' productivity
  - main measures of research output for academic economists are their publications
  - for individual i, cohort c, department d, field of study f, year t, labor market experience exp

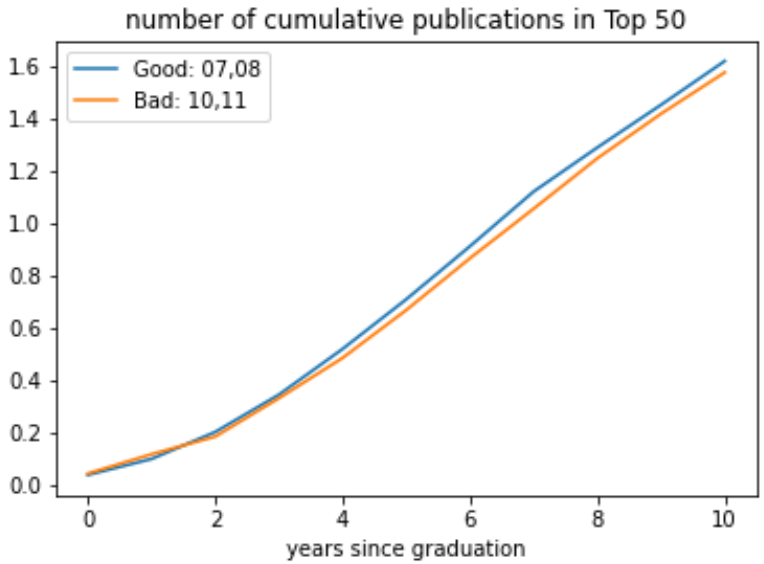
$$y_{icdft} = \beta \text{ec}_c + \gamma X_i + \xi_d + \theta_f + \mu_{exp} + \epsilon_{icdft}$$

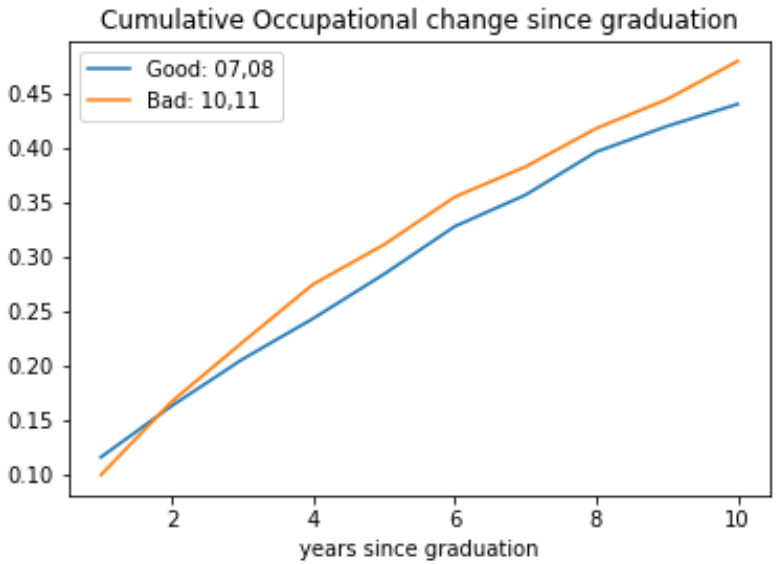
  where ec_c indicates the economic conditions at graduation for c
  - y_{icdft} is the number of publications in top economics journals
  - X_i includes an indicator for receiving bachelor degrees in the U.S. and gender

Cohort Effects at Entry



Cohort Effects over time





Effect of entry conditions on the initial placement in R1 universities

	(1)	(2)	(3)	(4)
unemployment (β_u)	-0.0214***	-0.0285**	-0.0177**	-0.0313***
	(0.00468)	(0.0104)	(0.00655)	(0.00582)
female	0.00654	0.00569	0.00624	0.00651
	(0.0155)	(0.0145)	(0.0146)	(0.0156)
US bachelor degree	0.0594***	0.0661***	0.0594***	0.0593***
	(0.0108)	(0.0114)	(0.0108)	(0.00867)
rank 2		-0.113***		
		(0.0143)		
rank 3		-0.127***		
		(0.0191)		
unemployment× rank 2 (β_1)		0.0162		
		(0.0150)		
unemployment× rank 3 (β_2)		0.00955		
		(0.0179)		
unemployment× female (β_1)			-0.0129	
			(0.0148)	
unemployment× usa (β_1)				0.0227***
				(0.00627)
P-val from F-test				
$\beta_u + \beta_1 = 0$		0.3005	0.0272	0.1538
$\beta_u + \beta_2 = 0$		0.1105		
N	3946	3946	3946	3946
R^2	0.061	0.040	0.061	0.062

Standard errors in parentheses and are clustered by cohort level. * $p < 0.10$, ** $p < .05$, *** $p < .01$
Department and fields of study fixed effects are included in the estimation except column (2)
rank 2 and *rank 3* are indicators for whether graduated from 11–23 and 24–45 ranked departments

Effect of entry conditions on the initial placement in rankings

	(1)	(2)	(3)	(4)
unemployment (β_u)	-3.713	-1.578	-6.915	1.525
	(4.901)	(4.601)	(5.794)	(3.778)
female	1.802	-0.316	3.004	1.963
	(5.686)	(5.753)	(3.988)	(5.792)
US bachelor degree	13.55**	7.669	13.48**	12.44**
	(4.977)	(7.184)	(5.012)	(4.255)
rank 2		114.6***		
		(9.667)		
rank 3		146.3***		
		(6.076)		
unemployment× rank 2 (β_1)		-11.35		
		(9.875)		
unemployment× rank 3 (β_2)		2.744		
		(6.769)		
unemployment × female (β_1)			10.67**	
			(3.746)	
unemployment× US bachelor (β_1)				-9.582
				(5.835)
P-val from F-test				
$\beta_u + \beta_1 = 0$		0.1146	0.2433	0.2696
$\beta_u + \beta_2 = 0$		0.8830		
N	1304	1304	1304	1304
R^2	0.246	0.170	0.247	0.247

Standard errors in parentheses and are clustered by cohort level. * $p < 0.10$, ** $p < .05$, *** $p < .01$
Department and fields of study fixed effects are included in the estimation except column (2)
rank 2 and *rank 3* are indicators for whether graduated from 11–23 and 24–45 ranked departments
Department ranks are quoted from *econphd.net rankings 2004*

Effect of entry conditions on the initial placement: multinomial logit

	(1)	(2)
2. all other universities		
unemployment	-0.106**	-0.0838*
	(0.0454)	(0.0499)
3. research org		
unemployment	0.138**	0.134**
	(0.0663)	(0.0630)
4. foreign institute		
unemployment	0.188***	0.188***
	(0.0431)	(0.0447)
5. private sectors		
unemployment	-0.0247	-0.0181
	(0.0403)	(0.0364)
FX		department, fields of study
N	3979	3916

Base is R1 university

Control for gender and US bachelor degrees.

Standard errors in parentheses and are clustered by cohort level.

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Effect of entry conditions on the placement in R1 universities over time

	(1) initial	(2) 5 years	(3) 9 years	(4) initial	(5) 5 years	(6) 9 years
unemployment (β_u)	-0.0214***	-0.0121*	-0.00821*	-0.0172**	-0.00550	-0.00502
	(0.00483)	(0.00595)	(0.00434)	(0.00654)	(0.00612)	(0.00434)
female	0.00616	-0.00878	-0.0182*	0.00586	-0.00568	-0.0167*
	(0.0160)	(0.0161)	(0.00930)	(0.0149)	(0.0133)	(0.00849)
US bachelor degree	0.0589***	0.103***	0.106***	0.0588***	0.103***	0.106***
	(0.0109)	(0.00947)	(0.0148)	(0.0109)	(0.00937)	(0.0147)
unemployment × female (β_1)				-0.0144	-0.0227	-0.0109
				(0.0148)	(0.0132)	(0.00807)
P-val from F-test						
$\beta_u + \beta_1 = 0$				0.0259	0.0538	0.0814
N	3916	3916	3916	3916	3916	3916
R^2	0.063	0.064	0.065	0.063	0.065	0.065

Dependent variable is whether one work at R1 university

Standard errors in parentheses and are clustered by cohort level. * $p < 0.10$, ** $p < .05$, *** $p < .01$

Department and fields of study fixed effects are included in the estimations.

Discussion

- Note that the magnitudes of the effects is way smaller than the initial impact
  - some individuals might switch the occupations but not enough to close the initial gaps
- Further test whether one ever switch occupation or firm
  - as the model predicted:
    - less likely switch the occupation
    - if one switched, it would happen within the same occupations at early periods
- Other explanations: entry conditions would serve as a signal of ability
  - its importance as a signal declines over time as more information of true ability is revealed appendix

Effect of entry conditions on the Job mobility

	Occupational switching			Firm switching		
	(1)	(2)	(3)	(4)	(5)	(6)
	$\leq$ 3 years	$\leq$ 6 years	$\leq$ 9 years	$\leq$ 3 years	$\leq$ 6 years	$\leq$ 9 years
unemployment	-0.00146	0.00261	-0.00127	0.0167***	0.0150	0.00952
	(0.00599)	(0.00825)	(0.00880)	(0.00429)	(0.0100)	(0.00814)
female	0.00543	0.0221	0.00707	0.0181**	0.00496	-0.00500
	(0.00679)	(0.0166)	(0.0172)	(0.00729)	(0.0155)	(0.0134)
US bachelor degree	-0.00557	-0.0209	-0.0305*	0.0262	0.00766	-0.00159
	(0.00976)	(0.0127)	(0.0150)	(0.0190)	(0.0162)	(0.0142)
N	3916	3916	3916	3916	3916	3916
R^2	0.030	0.030	0.020	0.048	0.049	0.031

Department, fields of study and initial placement occupation fixed effects are included

Standard errors in parentheses and are clustered by cohort level.

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Effect of entry conditions on the Publications

	(1) top 50	(2) top 50	(3) top 20	(4) top 20	(5) top 5	(6) top 5
unemployment	-0.0213***	-0.0233**	-0.0128***	-0.0138**	-0.00339	-0.00386
	(0.00795)	(0.00978)	(0.00487)	(0.00589)	(0.00232)	(0.00291)
female	-0.288***	-0.287***	-0.159***	-0.158***	-0.0813***	-0.0813***
	(0.0240)	(0.0240)	(0.0145)	(0.0145)	(0.00786)	(0.00785)
US bachelor degree	0.00424	0.00429	-0.0286***	-0.0286***	-0.00680	-0.00681
	(0.0119)	(0.0119)	(0.0102)	(0.0102)	(0.00422)	(0.00423)
experience		0.161***		0.0892***		0.0323***
		(0.00259)		(0.00150)		(0.00108)
N	50311	50311	50311	50311	50311	50311
R^2	0.169	0.168	0.131	0.130	0.097	0.096

Standard errors in parentheses and are clustered by cohort and current year t. * $p < 0.10$, ** $p < .05$, *** $p < .01$

Department and fields of study fixed effects are included in the estimation

Experience fixed effects are included in column (1), (3), (5)

Journal rankings are quoted from *IDEAS/RePEc Simple Impact Factors for Journals* .

Robustness Check

- In the analysis above, assume that the macroeconomic conditions at graduation represent an exogenous labor demand shock
  - the average quality of graduates who enters the market is not systematically associated with the economic conditions
- Note that five years of study is arguably the norm of the economics Ph.D. programs
- Examine the effect of the entry economic conditions on one's decision to delay graduation
  - individuals rank 1 programs would have an option to delay
  - revisit the previous findings using individuals from rank2 and rank 3 programs

Robustness Check: Effect of of economic conditions on delaying graduation

	(1)	(2)	(3)	(4)
unemployment (β_u)	0.0246	0.0486*	0.0243	0.0209
	(0.0136)	(0.0240)	(0.0167)	(0.0161)
female	0.0211	0.0103	0.0210	0.0211
	(0.0143)	(0.0149)	(0.0145)	(0.0142)
US bachelor degree	-0.0224	-0.0259	-0.0224	-0.0226
	(0.0359)	(0.0359)	(0.0359)	(0.0359)
rank 2		0.0101		
		(0.0283)		
rank 3		-0.0165		
		(0.0397)		
unemployment× rank 2 (β_1)		-0.0277		
		(0.0166)		
unemployment× rank 3 (β_2)		-0.0602		
		(0.0448)		
unemployment × female (β_1)			0.000804	
			(0.0161)	
unemployment × usa (β_1)				0.00838
				(0.0297)
P-val from F-test				
$\beta_u + \beta_1 = 0$		0.2436	0.0759	0.2618
$\beta_u + \beta_2 = 0$		0.6920		
N	2372	2372	2372	2372
R^2	0.069	0.027	0.069	0.069

Dependent variable is whether one studied more than 5 years

Standard errors in parentheses and are clustered by cohort level.

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Department and fields of study fixed effects are included in the estimation except (2)

Robustness Check: Regressions without graduates from rank 1 school

	(1) R1 short run	(2) R1 long run	(3) top 50	(4) top 20	(5) top 5
unemployment	-0.0173**	-0.00821*	-0.0317***	-0.0222***	-0.0085**
	(0.00737)	(0.00434)	(0.00751)	(0.00523)	(0.00272)
female	0.0189	-0.0182*	-0.221***	-0.127***	-0.0412***
	(0.0105)	(0.00930)	(0.0206)	(0.0133)	(0.0577)
US bachelor degree	0.0642**	0.106***	-0.0903***	-0.0982***	0.0008
	(0.0259)	(0.0148)	(0.0205)	(0.0155)	(0.0057)
N	2148	3916	27552	27552	27552
R^2	0.053	0.065	0.128	0.087	0.049

Standard errors in parentheses clustered by cohort and current year t.

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Department and fields of study fixed effects are included in the estimation.

Experience fixed effects are included in (3), (4), (5).

Discussions: Possible Concerns

- Incomplete data extraction
  - about 12 percent of individuals have no records from ProQuest listings
- Measurement errors
  - possible mismatch between the degree date and market entry
  - some could intentionally hide the previous positions
- Selection issues on CV / resume
  - maybe more successful individuals would update CVs more
- Matching errors
  - Duplicated names

Conclusion

- The entry economic conditions did affect the initial placements and subsequent occupational choice
  - recessionary cohorts less likely to work at R1 university and publish fewer articles
- My model points to the direction of mobility and it will make the initial effects remain longer
  - economists would develop task-specific human capital, and the tasks in each occupations would be specialized
- I will examine further firm mobility instead of occupation and whether the entry condition would affect the quality of the firms in the long run

Fuzzy matching

- One challenge of the task is scrape text data from the source document and convert them into suitable format
  - Scraping - use various APIs
    - might involve legal issues $\rightarrow$ commercial APIs
- Bigger challenge is that there are same institution but were taken as different forms
  - CV, dissertations, rank data, Journal entry
  - matching economists' names are even more complicated
- Employ learning methods from data science literature
  - data matching or fuzzy matching (probabilistic data matching)

Steps

- N-grams: a set of co-occurring words within a given sentence (Wang et al. 2006)
  - collect the words in the sentence having more meaning
- TF-IDF: count the word occurs in each document
  - evaluate how important a word is and (learning)
    - very important since the names have only a few words
  - long computing time ...
- Cosine similarity: how close the two sentences is
- Matching rates vary
  - JOE in US institutions: 89%
  - All institutions: 70%

back

Job description: Natural Language Processing

- Analyze the text in the job descriptions from JOE and CSWEP letters (central bank, consulting firms
- Most Frequently Appeared Words in job postings
  - Tenured track positions: **research, economics, teaching**, curriculum
  - Research org: **research, economics**, teaching
  - Private: **research**, economics, communication, work, policy, experience, analysis, skills, quantitative, management
- Word **research** and **teaching** dominates in Academic positions
- Diverse range of words are captured in private sector positions
  - communication related words are rarely captured in academic positions
- Possibly, different skills are required for the private sectors slide

Effect of entry conditions on the placement in R1 universities over time

	(1)	(2)
unemployment × exp 0	-0.0146**	0.00115
	(0.00608)	(0.00409)
unemployment × exp 2	-0.0122*	0.00355
	(0.00565)	(0.00482)
unemployment × exp 4	-0.0115*	0.00425
	(0.00578)	(0.00535)
unemployment × exp 6	-0.00770	0.00801
	(0.00510)	(0.00555)
unemployment × exp 8	-0.00701	0.00869
	(0.00454)	(0.00528)
female	-0.00672	-0.0115
	(0.0139)	(0.00664)
US bachelor degree	0.100***	0.0548***
	(0.00896)	(0.00809)
R1 university		0.773***
		(0.00897)
N	19580	19580
R^2	0.063	0.541

Standard errors in parentheses and are clustered by cohort level.
* $p < 0.10$, ** $p < .05$, *** $p < .01$

slide