# Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success

Joseph G. Altonji, Lisa B. Kahn, and Jamin D. Speer

Yale University and NBER, Yale University and IZA, Yale University

September 26, 2013

# Introduction

- Recessions have sizeable impacts on young workers
  - unemployment rate for recent college graduates went from 9% in 2007 to a peak of 17.6% in 2009 (BLS)
- Economic conditions at time of labor market entry can have persistent effects on careers
  - Kahn (2010), Oreopoulos, von Wachter and Heisz (2012), Oyer (2006 and 2008)
- Labor market returns vary greatly across college majors
  - gaps can be larger than the college premium; engineers earn 75% more than education majors (e.g., Altonji, Blom, and Meghir 2012)
- Do the effects of graduating in a recession differ across college major?
  - do high-return majors retain or expand their wage advantage? (Oreopoulos et al.)
  - or, does a general lack of opportunities compress these earnings differences?

# Why might entry conditions matter for careers?

- Time spent in unemployment
- Negative impact on quality of first job
  - Devereux 2002, Bils and McLaughlin 2001, Oyer (2006 and 2008), Liu, Salvanes, Sorenson (2012)
- Search frictions
  - "anti" Topel and Ward 1992
- Human capital
  - lack of access to training opportunities
  - less time gaining relevant skills (Gibbons and Waldman 2006)
  - skill depreciation
- Contracting
  - wage rigidities, bargaining power, wage insurance
    - (Baker, Gibbs and Holmstrom 1994, Beaudry and DiNardo 1991, Harris and Holmstrom 1982, MacLeod and Malcomson 1993)
  - learning/sorting (Gibbons, Katz, Lemieux, and Parent 2005)
  - promotion ladders/ports of entry

# Why differential effects across college major?

- Ability
  - high-skilled majors may be better at finding pockets of employment for themselves
- Versatility
  - high-skilled majors – higher returns to search? (Oreopoulos et al.)
  - high-skilled workers are more geographically mobile (Wozniak 2010)
  - some majors may typically enter a wider range of occupations
- Post-schooling HC Accumulation/Depreciation
  - more important for high-skill majors?
  - technical majors at greater risk of depreciation?
- Differential impacts of business cycles across occ/ind and over time

# This Paper

- Analyze the short- and medium-term consequences of entry conditions
- Use 7 data sets w labor market outcomes and field of study in college
  - large sample sizes
- College graduates in the U.S. from 1976-2011
  - multiple expansions and contractions
- Range of labor market outcomes
  - earnings, wages, employment, occupational attainment, educational attainment
- Categorize 51 college majors into "skill" measures
  - average earnings premium

# This Paper We Ask:

1. What are the consequences of graduating into a worse economy, for the average major?

# This Paper We Ask:

1. What are the consequences of graduating into a worse economy, for the average major?
2. Do these consequences vary across college major?

# This Paper We Ask:

1. What are the consequences of graduating into a worse economy, for the average major?
2. Do these consequences vary across college major?
3. How have the answers to 1 and 2 changed in the Great Recession?

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
    - 11% and 3% decline in initial earnings and wages

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
    - 11% and 3% decline in initial earnings and wages
    - earnings effects last for several years, wage effects persist

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession
3. How have the answers to 1 and 2 changed in the Great Recession?

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession
3. How have the answers to 1 and 2 changed in the Great Recession?
   - overall impacts on earnings are worse – double what would have been expected given the size of the recession

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession
3. How have the answers to 1 and 2 changed in the Great Recession?
   - overall impacts on earnings are worse – double what would have been expected given the size of the recession
   - effects are evenly dispersed across college major

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession
3. How have the answers to 1 and 2 changed in the Great Recession?
   - overall impacts on earnings are worse – double what would have been expected given the size of the recession
   - effects are evenly dispersed across college major
   - the modern recession comes closer to "leveling the playing field"

# Preview of results

1. What are the consequences of graduating into a worse economy, for the average major?
   - 11% and 3% decline in initial earnings and wages
   - earnings effects last for several years, wage effects persist
2. Do these consequences vary across college major?
   - high-skilled majors are somewhat sheltered from the business cycle
   - widen their initial earnings advantage by a third when graduating into a large recession
3. How have the answers to 1 and 2 changed in the Great Recession?
   - overall impacts on earnings are worse – double what would have been expected given the size of the recession
   - effects are evenly dispersed across college major
   - the modern recession comes closer to "leveling the playing field"
   - changes in cyclicality of labor demand can partially account for these findings

# Disclaimer on Causality

- We estimate the causal effect of graduating into a worse economy
  - unlikely that students optimally time their leaving school (Kahn 2010)
- We describe heterogeneity in these effects across college major
- Selection into majors over the business cycle could bias our estimates
  - Blom (2013): students shift to higher return majors in response to a worse economy at age 20
  - Implies possible negative selection of high-skilled majors graduating in recessions
  - Also only 0.37 correlation between age-20 and age22 unemployment rate

# Outline

- Data
- Methodology
- Results on overall effects of entry conditions
- Differential effects across college major
  - some discussion of mechanisms
- Results on differential effects over time

Data

# Data Sources

- restrict sample to ages 22-35
- exclude those who graduates before 20 or after 24 (3%)

Appendix Table 1
Data Sources (Earnings Sample)

| Data source | Grad years | Earnings years | Earnings observations |
|---|---|---|---|
| NLSY79 | 1979-1989 | 1980-1993, 1995, 1997 | 9,102 |
| NLSY97 | 2000-2008 | 2003-2009 | 3,545 |
| NLS72 | 1976-1978 | 1977-1986 | 6,157 |
| BB 93/03 | 1993 | 1994, 1997, 2003 | 12,904 |
| BB 08/09 | 2008 | 2009 | 6,340 |
| NSCG 1993 | 1980-1990 | 1993 | 24,832 |
| NSCG 2003 | 1990-2000 | 2003 | 11,575 |
| ACS 09-11 | 1996-2010 | 2009-2011 | 284,557 |
| SIPP | 1976-2009 | 1984-2011 | 46,159 |

# Sample Coverage

$U_c$ = division unemployment rate in year of college graduation

Appendix Table 2
Unweighted Sample Coverage

| | Years since college graduation: | | | | | |
|---|---|---|---|---|---|---|
| $U_c$ | 1-2 | 3-4 | 5-7 | 8-10 | 11-13 | Total |
| <5% | 10,277 | 30,617 | 32,783 | 47,751 | 44,936 | 166,364 |
| 5-6% | 12,497 | 17,549 | 35,324 | 27,873 | 19,474 | 112,717 |
| 6-7% | 9,791 | 7,258 | 21,327 | 17,276 | 6,385 | 62,037 |
| 7-8% | 5,451 | 2,766 | 7,075 | 7,714 | 5,882 | 28,888 |
| 8-9% | 5,921 | 1,206 | 2,028 | 4,172 | 2,024 | 15,351 |
| >9% | 10,214 | 1,050 | 1,866 | 3,794 | 2,900 | 19,824 |
| Total | 54,151 | 60,446 | 100,403 | 108,580 | 81,601 | 405,181 |

# Description of Key Variables

| | Typical Method: | Exceptions: | Sample Restrictions: |
|---|---|---|---|
| Graduation Year | direct question/inferred | ACS: impose 22 | |
| Census Division | at time of graduation or current residence | | |
| Labor Market Conditions | Division unemployment rate in year of graduation (robust to region) | | |
| College Major | map into 51 Dept of Ed codes | SIPP: treat separately or use crosswalk | |
| Earnings | Prior 12 months or calendar year | -- Current salary (NSCG, BB93)<br>-- wage*hours (NLS72) | non-enrolled, >$500, top-coded to $400K |
| Wages | Hourly wage, current salary, earnings/hours | | earnings sample coded to $5-$250 |
| Occupation | Current or primary occupation (1990 Three-Digit Census Codes) | | earnings sample |
| Employed | At the time of survey | SIPP: share of months employed | non-enrolled |
| Full-time | Usually work >35 hrs/wk | -- ft/pt (NSCG, BB93)<br>-- fraction of yr >35 (SIPP) | non-enrolled |
| Enrolled | Enrolled at time of survey | -- Unavailable (NSCG93, NLS72, 1984 SIPP)<br>-- fraction of yr enrolled | |

# Major Characteristics

- Major fixed effects in an earnings regression ($\beta^{major}$)
  - pool all data sources for ages 36-59
  - separately for SIPP
- Robust to:
  - SAT math score (from BB)
  - Occupation skill level based on O*NET task measures and typical major-occupation mapping

# Major Characteristics – in standard deviations

Table 2: Characteristics of Department of Education Major Categories

| Major: | $\beta^{major}$ | SAT Math | | $\beta^{major}$ | SAT Math |
|---|---|---|---|---|---|
| Chemical Engineering | 1.87 | * | Public Admin/Law | -0.01 | * |
| Economics | 1.57 | 1.51 | Multidisc./ General Sci | -0.04 | * |
| Electrical Engineering | 1.49 | 2.60 | Journalism | -0.06 | * |
| Finance | 1.41 | 0.70 | Architecture | -0.06 | * |
| Mechanical Engineering | 1.30 | 1.91 | History | -0.21 | 0.19 |
| Chemistry | 1.26 | 1.11 | Communications | -0.25 | -0.70 |
| Computer Programming | 1.21 | * | Public Health | -0.50 | * |
| All Other Engineering | 1.05 | 1.76 | Protective Services | -0.54 | * |
| Computer and Info Tech | 1.04 | 0.81 | Letters: Lit, Writing, Other | -0.66 | 0.28 |
| Biological Sciences | 1.04 | 1.05 | Foreign Language | -0.69 | 0.41 |
| Civil Engineering | 1.03 | 1.49 | Environmental Studies | -0.74 | 0.25 |
| Accounting | 0.95 | * | Psychology | -0.75 | -0.48 |
| Nursing | 0.87 | -0.50 | Other Social Science | -0.79 | -0.69 |
| Mathematics | 0.83 | 1.45 | Leisure Studies/Basic Skills | -0.82 | -1.23 |
| Political Science | 0.78 | 0.00 | Fitness and Nutrition | -1.07 | -0.99 |
| Physics | 0.72 | * | Commercial Art and Design | -1.11 | -0.45 |
| International Relations | 0.68 | 0.47 | Agriculture and Agr. Science | -1.16 | 0.10 |
| Marketing | 0.56 | -0.31 | Social Work & HR | -1.20 | -1.35 |
| Other Med/Health Services | 0.52 | -0.50 | Family and Consumer Science | -1.33 | -1.36 |
| Misc. Bus. and Med. Support | 0.50 | * | Art History and Fine Arts | -1.47 | 0.28 |
| Precision Prod. & Ind. Arts | 0.40 | * | Secondary Education | -1.48 | * |
| Medical Tech | 0.38 | * | Library Science and Ed. | -1.56 | -0.96 |
| Business Mgmt and Admin | 0.16 | -0.30 | Film and Other Arts | -1.77 | -0.11 |
| Earth and Other Physical Sci | 0.13 | * | Music and Speech/Drama | -1.90 | -0.52 |
| Area, Ethnic, and Civ. Studies | 0.05 | 0.54 | Philosophy and Religion | -2.47 | 0.72 |
| Engineering Tech | 0.00 | -0.30 | | | |

# Methodology

# Regression Model

$$
\begin{aligned}
outcome_{ict} \quad = \quad & \beta_1 U_c + \beta_2 U_c PE_{it} + \beta_3 U_c PE_{it}^2 \\
& + \beta_4 \beta_i^{major} U_c + \beta_5 \beta_i^{major} U_c PE_{it} \\
& \boldsymbol{\beta}_6 \mathbf{X}_{it} + \beta_7 \beta_i^{major} PE_{it} + \gamma^{major} + \delta_t + \varepsilon_{ict}
\end{aligned}
$$

- $i$ : individual, $c$ : graduation cohort (division-year), $t$ : calendar time
- $U_c$ : graduating unemployment rate
- $PE$ = years since college graduation (potential experience)
- $\beta^{major}$ : earnings return to the major
- $X_{it}$ : survey fe's, quadratic in $PE$, gender$*$race, gender$*PE$, division, division unemployment rate in $t$
- Subsequently add graduation year fe's
- Various dealings with standard errors

# Two-Step Estimation

- Objective: estimate average effects of $U_c$ and $\beta^{major} U_c$ over long period
- Data heavily skewed towards recent period due to ACS
- Equal weights on each *cp*-cell inefficient
- Our partial solution:

1. regress outcome on other control variables using pooled sample and survey weights and *mcp*-fixed effects
2. collapse data to *mcp*-level
3. regress *mcp* fixed effects on main variables of interest
   1. weight to preserve time-varying distribution of majors $(\frac{n_{mcp}}{n_{cp}})$
   2. drop small cells ($n_{cp} \leq 100$ earnings obs, 4.4% of unweighted sample)
   3. trim residual outliers (0.75% of unweighted sample)

Results for $U_c$

# Annual Earnings Regression Results

Annual Earnings as a Function of Entry Conditions and Major Characteristics

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Entry unemployment rate ($U_c$) | -0.0277*** | -0.0278*** | | |
| | (0.0053) | (0.0051) | | |
| $U_c$*potexp | 0.0076*** | 0.0080*** | | |
| | (0.0020) | (0.0020) | | |
| $U_c$*potexp$^2$ | -0.0005***) | -0.0006* | | |
| | (0.0002) | (0.0002) | | |
| $\beta^{major}$ | 0.1683*** | | | |
| | (0.0074) | | | |
| $\beta^{major}$*potexp | 0.0041*** | 0.0033*** | | |
| | (0.0011) | (0.0011) | | |
| $\beta^{major}$* $U_c$ | 0.0077* | 0.0129*** | | |
| | (0.0041) | (0.0037) | | |
| $\beta^{major}$* $U_c$*potexp | -0.0008 | -0.0017*** | | |
| | (0.0006) | (0.0005) | | |
| Major fixed effects | | X | | |
| Grad year fixed effects | | | | |
| Cluster by cohort | X | X | | |
| Cluster by cohort-major | | | | |
| Observations | 51,716 | 51,716 | | |
| R-squared | 0.295 | 0.322 | | |

*** p<0.01, ** p<0.05, * p<0.1

# Graduating into a Large Reccesion

Table 4: Effect of 4-ppt Rise in Graduation Unemployment Rate

| | Dependent Variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | | | |
| | All | | | | |
| | (1) | | | | |
| Average effect | -0.0311*** | | | | |
| (s.e.) | (0.0114) | | | | |
| Effect at potexp = | | | | | |
| 1 | -0.1114*** | | | | |
| | (0.0206) | | | | |
| 3 | -0.0565*** | | | | |
| | (0.0134) | | | | |
| 7 | 0.0001 | | | | |
| | (0.0147) | | | | |
| 10 | -0.0039 | | | | |
| | (0.0137) | | | | |

*** p<0.01, ** p<0.05, * p<0.1

# Graduating into a Large Reccesion

Table 4: Effect of 4-ppt Rise in Graduation Unemployment Rate

| | Dependent Variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | | | |
| | All | Full-time | | | |
| | (1) | (2) | | | |
| Average effect | -0.0311*** | -0.0167* | | | |
| (s.e.) | (0.0114) | (0.0094) | | | |
| Effect at potexp = | | | | | |
| 1 | -0.1114*** | -0.0460** | | | |
| | (0.0206) | (0.0186) | | | |
| 3 | -0.0565*** | -0.0214* | | | |
| | (0.0134) | (0.0119) | | | |
| 7 | 0.0001 | -0.0043 | | | |
| | (0.0147) | (0.0112) | | | |
| 10 | -0.0039 | -0.0197* | | | |
| | (0.0137) | (0.0105) | | | |

*** p<0.01, ** p<0.05, * p<0.1

# Graduating into a Large Reccesion

Table 4: Effect of 4-ppt Rise in Graduation Unemployment Rate

| | Dependent Variable: | | | |
|---|---|---|---|---|
| | Earnings: | | Employment: | |
| | All | Full-time | Pr(Employed) | Pr(Full time) |
| | (1) | (2) | (3) | (4) |
| Average effect | -0.0311*** | -0.0167* | -0.0006 | -0.0054 |
| (s.e.) | (0.0114) | (0.0094) | (0.0040) | (0.0064) |
| Effect at potexp = | | | | |
| 1 | -0.1114*** | -0.0460** | 0.0008 | -0.0947*** |
| | (0.0206) | (0.0186) | (0.0067) | (0.0128) |
| 3 | -0.0565*** | -0.0214* | 0.0026 | -0.0261*** |
| | (0.0134) | (0.0119) | (0.0047) | (0.0078) |
| 7 | 0.0001 | -0.0043 | -0.0005 | 0.0310*** |
| | (0.0147) | (0.0112) | (0.0048) | (0.0082) |
| 10 | -0.0039 | -0.0197* | -0.0086 | 0.0036 |
| | (0.0137) | (0.0105) | (0.0052) | (0.0081) |

*** p<0.01, ** p<0.05, * p<0.1

# Graduating into a Large Reccesion

Table 4: Effect of 4-ppt Rise in Graduation Unemployment Rate

| | Dependent Variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | Employment: | | |
| | All | Full-time | Pr(Employed) | Pr(Full time) | Wages |
| | (1) | (2) | (3) | (4) | (5) |
| Average effect | -0.0311*** | -0.0167* | -0.0006 | -0.0054 | -0.0311*** |
| (s.e.) | (0.0114) | (0.0094) | (0.0040) | (0.0064) | (0.0101) |
| Effect at potexp = | | | | | |
| 1 | -0.1114*** | -0.0460** | 0.0008 | -0.0947*** | -0.0360** |
| | (0.0206) | (0.0186) | (0.0067) | (0.0128) | (0.0155) |
| 3 | -0.0565*** | -0.0214* | 0.0026 | -0.0261*** | -0.0293** |
| | (0.0134) | (0.0119) | (0.0047) | (0.0078) | (0.0117) |
| 7 | 0.0001 | -0.0043 | -0.0005 | 0.0310*** | -0.0284** |
| | (0.0147) | (0.0112) | (0.0048) | (0.0082) | (0.0125) |
| 10 | -0.0039 | -0.0197* | -0.0086 | 0.0036 | -0.0386*** |
| | (0.0137) | (0.0105) | (0.0052) | (0.0081) | (0.0113) |

*** p<0.01, ** p<0.05, * p<0.1

# Measuring Occupational Attainment

1. Overall Quality = earnings return to the occupation
   - regress earnings on occupation fe's + controls with ACS data ages 25-59
2. Match Quality = in one of the top 5 occupations for the major
   - top 5 defined with ACS data on college graduates ages 25-59

# Graduating into a Large Reccesion

Table 4: Effect of 4-ppt Rise in Graduation Unemployment Rate on Occupational Attainment

| | Earnings Return | Pr(in top 5 for major) |
|---|---|---|
| | (6) | (7) |
| Average effect | -0.0038 | -0.0149 |
| (s.e.) | (0.0056) | (0.0111) |
| Effect at potexp = | | |
| 1 | -0.0107 | -0.0256* |
| | (0.0081) | (0.0155) |
| 3 | -0.0069 | -0.0183 |
| | (0.0062) | (0.0117) |
| 7 | -0.0014 | -0.0108 |
| | (0.0071) | (0.0140) |
| 10 | 0.0009 | -0.0112 |
| | (0.0059) | (0.0123) |

*** p<0.01, ** p<0.05, * p<0.1

Results for $\beta_i^m U_c$

# Annual Earnings Regression Results

Annual Earnings as a Function of Entry Conditions and Major Characteristics

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Entry unemployment rate ($U_c$) | -0.0277*** | -0.0278*** | -0.0291*** | -0.0291*** |
| | (0.0053) | (0.0051) | (0.0052) | (0.0066) |
| $U_c$*potexp | 0.0076*** | 0.0080*** | 0.0080*** | 0.0080*** |
| | (0.0020) | (0.0020) | (0.0018) | (0.0021) |
| $U_c$*potexp$^2$ | -0.0005***) | -0.0006* | -0.0005*** | -0.0005*** |
| | (0.0002) | (0.0002) | (0.0001) | (0.0002) |
| $\beta^{major}$ | 0.1683*** | | | |
| | (0.0074) | | | |
| $\beta^{major}$*potexp | 0.0041*** | 0.0033*** | 0.0031*** | 0.0031*** |
| | (0.0011) | (0.0011) | (0.0008) | (0.0010) |
| $\beta^{major}$* $U_c$ | 0.0077* | 0.0129*** | 0.0135*** | 0.0135*** |
| | (0.0041) | (0.0037) | (0.0027) | (0.0037) |
| $\beta^{major}$* $U_c$*potexp | -0.0008 | -0.0017*** | -0.0020*** | -0.0020*** |
| | (0.0006) | (0.0005) | (0.0004) | (0.0005) |
| Major fixed effects | | X | X | X |
| Grad year fixed effects | | | X | X |
| Cluster by cohort | X | X | | |
| Cluster by cohort-major | | | | X |
| Observations | 51,716 | 51,716 | 51,716 | 51,716 |
| R-squared | 0.295 | 0.322 | 0.327 | 0.327 |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

Table 5: Effects of 4 ppt rise in $U_c$ interacted with $\beta^{major}$

| | Dependent variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | Employment: | | |
| | All | | | | |
| | (1) | | | | |
| | Panel A: Coefficients on $\beta^{major}$ | | | | |
| Main effect | 0.1683*** | | | | |
| (s.e.) | (0.0074) | | | | |
| | Panel B: Interaction of $\beta^{major}$ and $U_c$ | | | | |
| Average effect | 0.0179*** | | | | |
| (s.e.) | (0.0063) | | | | |
| Effect at potexp = | | | | | |
| 1 | 0.0538*** | | | | |
| | (0.0108) | | | | |
| 3 | 0.0379*** | | | | |
| | (0.0083) | | | | |
| 7 | 0.0059 | | | | |
| | (0.0061) | | | | |
| 10 | -0.0180** | | | | |
| | (0.0083) | | | | |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

Table 5: Effects of 4 ppt rise in $U_c$ interacted with $\beta^{major}$

| | Dependent variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | Employment: | | |
| | All | Full-time | | | |
| | (1) | (2) | | | |
| | Panel A: Coefficients on $\beta^{major}$ | | | | |
| Main effect | 0.1683*** | 0.1541*** | | | |
| (s.e.) | (0.0074) | (0.0062) | | | |
| | Panel B: Interaction of $\beta^{major}$ and $U_c$ | | | | |
| Average effect | 0.0179*** | 0.0189*** | | | |
| (s.e.) | (0.0063) | (0.0054) | | | |
| Effect at potexp = | | | | | |
| 1 | 0.0538*** | 0.0315*** | | | |
| | (0.0108) | (0.0094) | | | |
| 3 | 0.0379*** | 0.0259*** | | | |
| | (0.0083) | (0.0073) | | | |
| 7 | 0.0059 | 0.0147*** | | | |
| | (0.0061) | (0.0050) | | | |
| 10 | -0.0180** | 0.0063 | | | |
| | (0.0083) | (0.0065) | | | |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

Table 5: Effects of 4 ppt rise in $U_c$ interacted with $\beta^{major}$

| | Dependent variable: | | | |
|---|---|---|---|---|
| | Earnings: | | Employment: | |
| | All | Full-time | Pr(Employed) | Pr(Full time) |
| | (1) | (2) | (3) | (4) |
| | Panel A: Coefficients on $\beta^{major}$ | | | |
| Main effect | 0.1683*** | 0.1541*** | 0.0034 | 0.0367*** |
| (s.e.) | (0.0074) | (0.0062) | (0.0024) | (0.0042) |
| | Panel B: Interaction of $\beta^{major}$ and $U_c$ | | | |
| Average effect | 0.0179*** | 0.0189*** | 0.0040 | 0.0119*** |
| (s.e.) | (0.0063) | (0.0054) | (0.0027) | (0.0043) |
| Effect at potexp = | | | | |
| 1 | 0.0538*** | 0.0315*** | 0.0118** | 0.0208*** |
| | (0.0108) | (0.0094) | (0.0049) | (0.0079) |
| 3 | 0.0379*** | 0.0259*** | 0.0084** | 0.0168*** |
| | (0.0083) | (0.0073) | (0.0038) | (0.0061) |
| 7 | 0.0059 | 0.0147*** | 0.0014 | 0.0089** |
| | (0.0061) | (0.0050) | (0.0026) | (0.0039) |
| 10 | -0.0180** | 0.0063 | -0.0037 | 0.0030 |
| | (0.0083) | (0.0065) | (0.0034) | (0.0051) |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

Table 5: Effects of 4 ppt rise in $U_c$ interacted with $\beta^{major}$

| | Dependent variable: | | | | |
|---|---|---|---|---|---|
| | Earnings: | | Employment: | | |
| | All | Full-time | Pr(Employed) | Pr(Full time) | Wages |
| | (1) | (2) | (3) | (4) | (5) |
| | Panel A: Coefficients on $\beta^{major}$ | | | | |
| Main effect | 0.1683*** | 0.1541*** | 0.0034 | 0.0367*** | 0.1382*** |
| (s.e.) | (0.0074) | (0.0062) | (0.0024) | (0.0042) | (0.0062) |
| | Panel B: Interaction of $\beta^{major}$ and $U_c$ | | | | |
| Average effect | 0.0179*** | 0.0189*** | 0.0040 | 0.0119*** | 0.0099* |
| (s.e.) | (0.0063) | (0.0054) | (0.0027) | (0.0043) | (0.0054) |
| Effect at potexp = | | | | | |
| 1 | 0.0538*** | 0.0315*** | 0.0118** | 0.0208*** | 0.0110 |
| | (0.0108) | (0.0094) | (0.0049) | (0.0079) | (0.0095) |
| 3 | 0.0379*** | 0.0259*** | 0.0084** | 0.0168*** | 0.0105 |
| | (0.0083) | (0.0073) | (0.0038) | (0.0061) | (0.0072) |
| 7 | 0.0059 | 0.0147*** | 0.0014 | 0.0089** | 0.0095* |
| | (0.0061) | (0.0050) | (0.0026) | (0.0039) | (0.0054) |
| 10 | -0.0180** | 0.0063 | -0.0037 | 0.0030 | 0.0088 |
| | (0.0083) | (0.0065) | (0.0034) | (0.0051) | (0.0075) |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

Differential Effects on Occupational Attainment

| | Earnings Return | Pr(in top 5 for major) |
|---|---|---|
| | (6) | (7) |
| Main effect | 0.1457*** | 0.0030 |
| (s.e.) | (0.0037) | (0.0073) |
| Average effect | 0.0070** | 0.0095* |
| (s.e.) | (0.0030) | (0.0055) |
| Effect at potexp = | | |
| 1 | 0.0170*** | 0.0045 |
| | (0.0051) | (0.0092) |
| 3 | 0.0125*** | 0.0067 |
| | (0.0040) | (0.0071) |
| 7 | 0.0037 | 0.0112** |
| | (0.0029) | (0.0054) |
| 10 | -0.0030 | 0.0146** |
| | (0.0038) | (0.0071) |

*** p<0.01, ** p<0.05, * p<0.1

# Differential Effect Across Major (Large Recession)

- Results are similar for men and women
- Similar using SAT Math and Skill-level of Occupation

Can Differential Cyclicality of Labor Demand Account for these findings?

# Major-Specific Unemployment Rates

- Use CPS data to create occupation-industry-specific unemployment rates
  - three-digit occs, 12 major ind categories

$$\frac{\#\ \textit{unemp}\ \text{previousl employed in occ-ind}}{\#\ \textit{unemp} + \#\ \text{emp in occ-ind}}$$

- Map majors to occupation-industry cells
  - use largest data sets (ACS & NSCG) ages 25-59
  - by major, obtain n in each occ-ind cell
  - use n as weights to take weighted average of unemployment rates

# Major-Specific Unemployment Rates

Table 6: Major-Specific Unemployment Rates

| | Dependent Variable: $U_c^{major}$ |
|---|---|
| | 1971-2012 |
| | (1) |
| Entry unemployment rate ($U_c$) | 0.2546*** |
| | (0.0043) |
| $\beta^{major}$ | -0.0373* |
| | (0.0218) |
| $\beta^{major} * U_c$ | -0.0233*** |
| | (0.0033) |
| Cubic time trend | X |
| Observations | 16,983 |
| R-squared | 0.452 |

*** p<0.01, ** p<0.05, * p<0.1

Occupation Concentration of Majors

# Occupation Concentration of Majors

- How do majors that typically enter a narrower range of jobs fare over the business cycle?
  - share of workers in top 5 most popular occupations for a given major
  - obtained from pooled data ages 25-36
- Most concentrated:
  - nursing, computer programming, education, accounting
- Least concentrated:
  - environmental studies, film and art, social science, art history

# Occupation Concentration of Majors

Table 7: Effects of 4 ppt rise in Uc interacted with major concentration ("top 5 share")

| | Dependent variable: | | | | | | |
|---|---|---|---|---|---|---|---|
| | Earnings: | | Employment: | | | Occupation Variables | |
| | All | Full-time | Pr(Employed) | Pr(Full time) | Wages | Earnings Return | Pr(in top 5 for major) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | Panel A: Coefficients on $\beta^{major}$ | | | | | | |
| Main effect | 0.0514*** | 0.0378*** | 0.0048** | 0.0073* | 0.0526*** | -0.0008 | 0.1497*** |
| (s.e.) | (0.0080) | (0.0069) | (0.0023) | (0.0039) | (0.0067) | (0.0047) | (0.0074) |
| | Panel B: Interaction of Major Characteristic and Entry Unemployment Rate | | | | | | |
| Average effect | -0.0119** | -0.0089* | -0.0046* | -0.0027 | -0.0135*** | -0.0010 | -0.0242*** |
| (s.e.) | (0.0061) | (0.0049) | (0.0025) | (0.004) | (0.0051) | (0.0029) | (0.0054) |
| Effect at potexp = | | | | | | | |
| 1 | -0.0267*** | -0.0186** | -0.0098** | -0.0043 | -0.0202** | -0.0047 | -0.0131 |
| | (0.0103) | (0.0086) | (0.0045) | (0.0076) | (0.0089) | (0.0049) | (0.0093) |
| 3 | -0.0201** | -0.0143** | -0.0075** | -0.0036 | -0.0172*** | -0.0031 | -0.0181** |
| | (0.0079) | (0.0066) | (0.0034) | (0.0058) | (0.0067) | (0.0038) | (0.0071) |
| 7 | -0.0070 | -0.0057 | -0.0028 | -0.0021 | -0.0113** | 0.0003 | -0.0279*** |
| | (0.0062) | (0.0048) | (0.0025) | (0.0038) | (0.0052) | (0.0028) | (0.0054) |
| 10 | 0.0029 | 0.0008 | 0.0006 | -0.0011 | -0.0068 | 0.0028 | -0.0354*** |
| | (0.0088) | (0.0066) | (0.0035) | (0.0051) | (0.0075) | (0.0038) | (0.0074) |

*** p<0.01, ** p<0.05, * p<0.1

Educational Attainment

# Measuring Educational Attainment

- Unbalanced panel makes education difficult to analyze in our pooled data
- Measure completed education in ACS
- Restrict to 1976-2006 cohorts with $\geq$ 5 yrs potexp

# Educational Attainment

Table 8: Probability of Attaining an Advanced Degree
Sample: ACS College Graduates who Graduated from 1976-2006

| | (1) | (2) | (3) |
|---|---|---|---|
| Entry unemployment rate ($U_c$) | 0.0012* | 0.0014** | 0.0014** |
| | (0.0007) | (0.0007) | (0.0007) |
| $\beta^{major}$ | 0.0122*** | | |
| | (0.0040) | | |
| $\beta^{major} * U_c$ | -0.0029*** | -0.0023*** | -0.0015*** |
| | (0.0006) | (0.0005) | (0.0005) |
| Major fixed effects | | X | X |
| Grad year fixed effects | X | X | X |
| Cluster at grad year-division | X | X | X |
| $\beta^{major}$ interacted with cubic time trend | | | X |
| Observations | 1,052,820 | 1,052,820 | 1,052,820 |
| R-squared | 0.011 | 0.083 | 0.083 |

*** p<0.01, ** p<0.05, * p<0.1

# Recap

- Graduating into a large recession:
  - 11% initial earnings losses
  - account for by 9.5 ppt reduction in Pr(full-time)
  - and persistent effects on wages (3% loss)
- High-skilled majors are somewhat sheltered
  - experience smaller losses to earnings, wages, and Pr(full-time)
  - more likely to be employed, achieve higher occupational attainment
  - typical earnings differences across major widen by a third when graduating into a recession
  - differences in cyclicality of labor demand are unlikely to be the whole story
- Modest positive effects on educational attainment overall, modest negative effects for high-skilled majors

How have these effects changed in the Great Recession?

# Earnings and Wage Results Across Time Period

Table 9: Labor Market Entry Effects in the Great Recession

| | Dependent variable | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Earnings: | | | | Employment: | | | | | |
| | All | | Full-time | | Pr(Employed) | | Pr(Full Time) | | Wages | |
| | Pre-04 | Post-04 | Pre-04 | Post-04 | Pre-04 | Post-04 | Pre-04 | Post-04 | Pre-04 | Post-04 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | Panel A: Effects of a 4 ppt rise in $U_c$, for those graduating before and after 2004 | | | | | | | | | |
| Average effect, 5 yrs | -0.0406*** | -0.0898*** | -0.0069 | -0.0595*** | 0.0016 | 0.0084 | -0.0456*** | -0.0018 | -0.0300** | -0.0527** |
| (s.e.) | (0.0145) | (0.0266) | (0.0146) | (0.0220) | (0.0059) | (0.0073) | (0.0100) | (0.0121) | (0.0137) | (0.0203) |
| Effect at potexp = | | | | | | | | | | |
| 1 | -0.0811*** | -0.1927*** | -0.0175 | -0.1229*** | -0.0018 | 0.0116 | -0.1186*** | -0.0329** | -0.0398** | -0.0288 |
| | (0.0230) | (0.0211) | (0.0230) | (0.0190) | (0.0089) | (0.0104) | (0.0170) | (0.0153) | (0.0193) | (0.0215) |
| 3 | -0.0374** | -0.0639* | -0.0053 | -0.0403 | 0.0022 | 0.0101 | -0.0381*** | 0.0027 | -0.0289** | -0.0420** |
| | (0.0144) | (0.0322) | (0.0143) | (0.0238) | (0.0059) | (0.0087) | (0.0097) | (0.0164) | (0.0137) | (0.0214) |
| | Panel B: Effects of 4 ppt rise in $U_c$ interacted with $\beta^{major}$, for those graduating before and after 2004 | | | | | | | | | |
| Average effect, 5 yrs | 0.0480*** | 0.0002 | 0.0306*** | -0.0030 | 0.0137*** | -0.0016 | 0.0228*** | -0.0003 | 0.0108 | -0.0031 |
| (s.e.) | (0.0106) | (0.0117) | (0.0090) | (0.0102) | (0.0046) | (0.0056) | (0.0077) | (0.0071) | (0.0094) | (0.0099) |
| Effect at potexp = | | | | | | | | | | |
| 1 | 0.0671*** | 0.0187 | 0.0377*** | 0.0000 | 0.0189*** | -0.0133* | 0.0288*** | 0.0013 | 0.0113 | 0.0022 |
| | (0.0138) | (0.0144) | (0.0121) | (0.0124) | (0.0060) | (0.0078) | (0.0100) | (0.0101) | (0.0124) | (0.0116) |
| 3 | 0.0480*** | 0.0002 | 0.0306*** | -0.0030 | 0.0137*** | -0.0016 | 0.0228*** | -0.0003 | 0.0108 | -0.0031 |
| | (0.0106) | (0.0117) | (0.0090) | (0.0102) | (0.0046) | (0.0056) | (0.0077) | (0.0071) | (0.0094) | (0.0099) |

# Discussion: heterogeneity across recessions

- Cutpoint robust from 1998 forward
- Recessions differ in the industries/groups who were most impacted
- 1981-82 and 1991: heavily in manufacturing (and construction for '91)
    - College Graduates may have been relatively more sheltered
- 2001 "dot com bust": may have impacted college graduates relatively more, especially in technical fields
- 2007-09: extremely broad-based
    - unemployment rates doubled for almost every subgroup, including college graduates

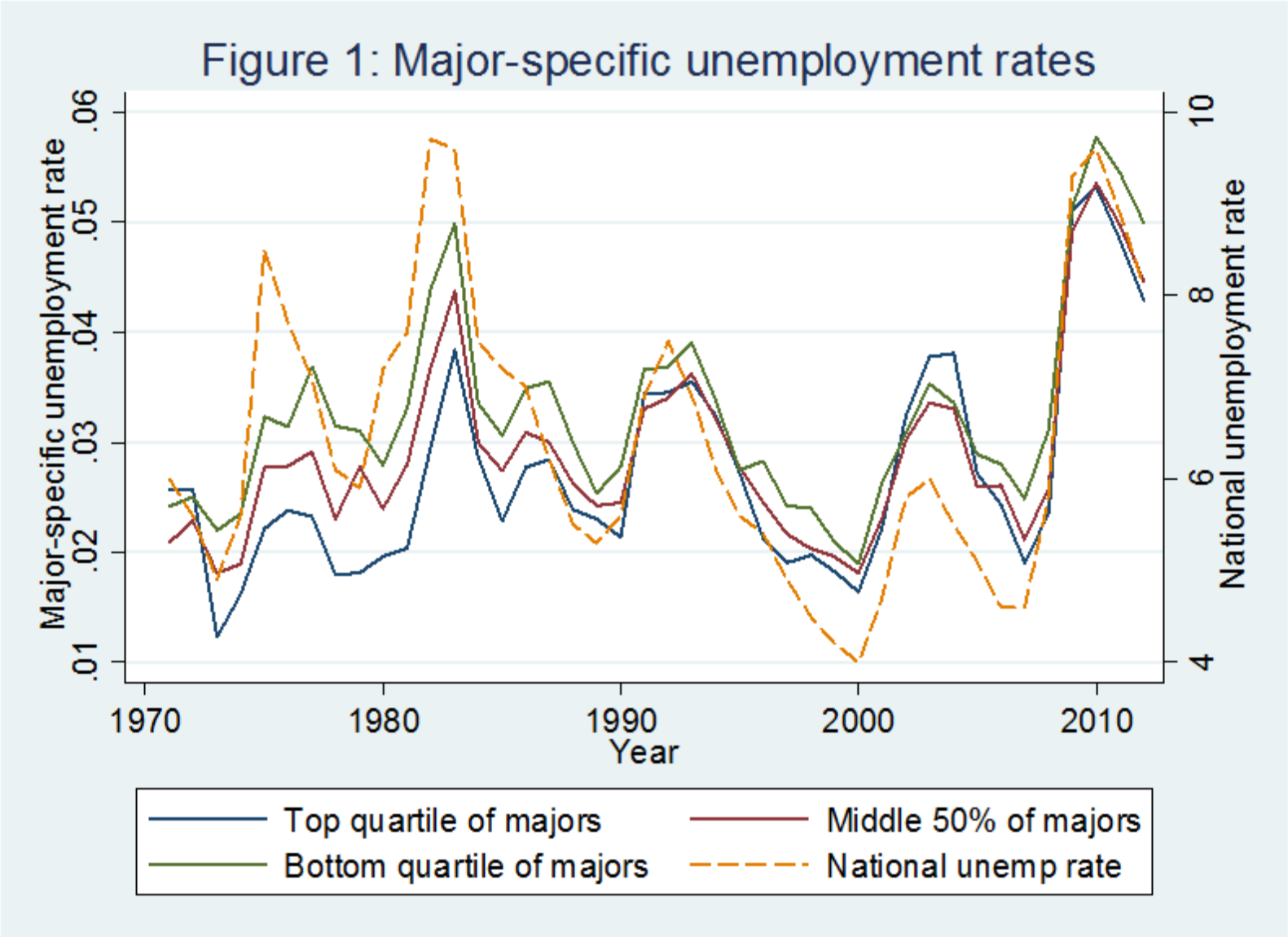
# Major-Specific Unemployment Rates

Table 6: Major-Specific Unemployment Rates

| | Dependent Variable: $U_c^{major}$ | | | |
|---|---|---|---|---|
| | 1971-2012 | 1971-2003 | 1971-2003 | 2004-2012 |
| | (1) | (2) | (3) | (4) |
| Entry unemployment rate ($U_c$) | 0.2546*** | 0.2046*** | 0.1988*** | 0.5078*** |
| | (0.0043) | (0.0040) | (0.0047) | (0.0071) |
| $\beta^{major}$ | -0.0373* | 0.0051 | 0.0051 | -0.0776 |
| | (0.0218) | (0.0246) | (0.0242) | (0.0478) |
| $\beta^{major} * U_c$ | -0.0233*** | -0.0331*** | -0.0331*** | -0.0087 |
| | (0.0033) | (0.0038) | (0.0038) | (0.0068) |
| Cubic time trend | X | | X | |
| Observations | 16,983 | 12,852 | 12,852 | 4,131 |
| R-squared | 0.452 | 0.222 | 0.246 | 0.559 |

*** p<0.01, ** p<0.05, * p<0.1

# Major-Specific Unemployment Rates



# Conclusion

- We study labor market outcomes of recent college graduates as a function of entry conditions and major skill
- A large recession:
  - reduces earnings and wages by 11% and 3% in the 1st year out
  - reduced Pr(full-time) by 9.5 ppts in 1st year out
  - widens the earnings gap across college majors by 1/3
  - most effects fade out over the first 7 years of a career, while wage effects persist
- In the Great Recession:
  - entry effects were worse overall for college graduates
  - high-skilled graduates were not sheltered

# Conclusion

- Why?
  - impacts on hours and earnings power both appear to be important
    - perhaps time spent out of FT work results in skill depreciation
  - little evidence of differential cyclicality of labor demand
  - little evidence of differential search and recovery
    - high-skilled majors are not differentially catching up
  - occupational attainment effects are strongly differential
    - consistent with Liu et al. (2012), Oyer (2006 and 2008), Oreopoulos et al. (2012)

Implications about "modern recessions"

- likely more evenly dispersed across skill-level
  - recent college grads fare worse relative to earlier periods
  - high-return majors lose their business cycle advantage
- our labor demand measures can explain the worsening overall for college graduates
  - but not the differential effects across majors

# Summary Statistics

Table 1: Summary Statistics for Primary Earnings Sample
with Equal Weighting across Cohort-Potential Experience Cells

| Variable | n | Mean | St Dev | Min | Max |
|---|---|---|---|---|---|
| Male | 400,923 | 0.48 | 0.50 | 0 | 1 |
| Black | 400,923 | 0.06 | 0.24 | 0 | 1 |
| Hispanic | 400,923 | 0.04 | 0.20 | 0 | 1 |
| Potential experience | 400,923 | 6.38 | 3.56 | 1 | 13 |
| Graduation year | 400,923 | 1990.29 | 8.70 | 1976 | 2010 |
| $U_c$ | 400,923 | 6.23 | 1.76 | 2.8 | 12.5 |
| Year | 400,923 | 1996.67 | 8.96 | 1977 | 2011 |
| Log annual earnings | 400,923 | 10.50 | 0.76 | 6.22 | 12.90 |
| Full-time | 400,923 | 0.85 | 0.33 | 0 | 1 |
| Summary Statistics for Relevant Samples | | | | | |
| Employed | 454,477 | 0.89 | 0.30 | 0 | 1 |
| Full-time | 454,477 | 0.77 | 0.40 | 0 | 1 |
| Log(earnings) cond'l FT | 352,364 | 10.68 | 0.56 | 6.22 | 12.90 |
| Top5 | 377,413 | 0.40 | 0.47 | 0 | 1 |
| Occupational log earnings return | 395,587 | -0.71 | 0.32 | -1.62 | 0.04 |
| Has advanced degree | 1,153,034 | 0.35 | 0.48 | 0 | 1 |