Efficient Supply of Human Capital: Role of College Major

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Motivation

- Need for efficient supply of human capital
  - Aging population
  - Low employment among young adults and women

Research Ideas

- College major
  - Important implications for labor market outcomes
  - Substantial gender gap in major choice
  - e.g., Hamermesh and Donald, 2008, Altonji et al., 2012, and Goldin, 2014

Research Ideas

- College major
  - Important implications for labor market outcomes
  - Substantial gender gap in major choice
  - e.g., Hamermesh and Donald, 2008, Altonji et al., 2012, and Goldin, 2014
- Conjecture
  - Assuming college majors are heterogeneous in producing human capital demanded in the labor market,

    a policy affecting individuals' college major choice can be used to increase human capital and labor market attachment of some subpopulations.

Research Ideas

- Research questions
  - To what extent does college major affect labor market outcomes?
  - To what extent can narrowing the gender gap in college majors improve women's labor market outcomes?

Setting: South Korea

- Policy relevance:
  - Rapidly aging population
  - Low employment among young adults and women
- Large gender gap in labor market outcomes:
  - Earnings: worst among the OECD countries (37% in 2012)
  - Female labor force participation rate: bottom among OECD
- College education:
  - Heavily regulated by Ministry of Education
  - College major quota: Potential policy instrument

Setting: South Korea

- Clean setting to measure causal impact
  - High school:
    - no formal education on college majors (e.g., AP course)
  - College admission:
    - based on standardized tests, not based on major-specific talents
    - students need to specify a major when applying for a college
      (up to 5 college-major combinations)
    - great uncertainty getting an admission

Empirical Framework

- Identification assumption
  - No unobservable heterogeneity conditional on CSAT scores and other observables.
- Framework
  Person i who majored in j, graduated from a college in year c, lives in location l and was surveyed in round r

$$Y_{ijclr} = \alpha_r female + \beta_r CSAT + \phi_{j,r} + \varphi_{c,r} + \theta_{l,r} + X'_{ir}\lambda_r + \epsilon_{igcst}$$

- Employment, having a regular position ...: logit specification
- Log monthly earnings: Mincerian

Testing Identification Assumption

- Possible violation of identification
  - A person knows her comparative advantage and applies to a particular major in college application, accordingly.

    $\Rightarrow$ intended college major $=$ actual college major
- Empirical test
  - Korean Education and Employment Panel (KEEP):
    - High-school seniors in 2004 (till 2011)
    - Small sample size but info on preferred college major
  - Multinomial logit models:
    - College major: 7 groups
    - Key variable: "whether a student intended to select a given major"
    - No explanatory power or sometimes negative coefficient

Testing Identification Assumption

- Multinomial logit models: Engineering (omitted)

Actual	1 if intended	female	CSAT
1 if Humanities	-0.63*	2.33***	0.61***
	(0.26)	(0.31)	(0.16)
1 if Social Science	0.40	1.74***	0.54
	(0.21)	(0.26)	(0.13)
1 if Education	0.32	2.43***	1.20***
	(0.35)	(0.41)	(0.24)
1 if Science	-0.56*	2.20**	0.18
	(0.25)	(0.30)	(0.16)
1 if Medicine/Health	0.21	2.74	1.37
	(0.43)	(0.52)	(0.30)
1 if Arts/Athletics	1.09***	2.43***	-1.42***
	(0.31)	(0.34)	(0.31)

Data

- Sample
  - Graduates Occupational Mobility Survey (GOMS)
  - 4-year college graduates in Korea (2004-2008 cohorts)
  - Labor market outcomes 2 year and 4 years after graduation

Summary Statistics

- College major: 7 groups
- Substantial gender difference

	Initial	
	Male	Female
No. of obs.	22,953	18,305
Age	27.96	25.62
Married (%)	10.75	7.25
College major (%)		
- Humanities	9.21	18.96
- Social Science	22.85	22.81
- Education	4.86	14.02
- Engineering	39.91	10.12
- Natural Science/Mathematics	13.28	16.32
- Medicine/Public Health	3.18	5.12
- Arts/Athletics	6.73	12.65

Summary Statistics

- College major: 7 groups
- Substantial gender difference
- Stable between initial and follow-up surveys

	Initial		Follow-up	
	Male	Female	Male	Female
No. of obs.	22,953	18,305	19,382	14,568
Age	27.96	25.62	29.91	27.56
Married (%)	10.75	7.25	28.79	19.16
College major (%)				
- Humanities	9.21	18.96	9.13	18.16
- Social Science	22.85	22.81	22.84	22.80
- Education	4.86	14.02	4.54	15.16
- Engineering	39.91	10.12	40.51	10.19
- Natural Science/Mathematics	13.28	16.32	13.46	16.44
- Medicine/Public Health	3.18	5.12	3.10	5.14
- Arts/Athletics	6.73	12.65	6.43	12.12

Summary Statistics

- Substantial gender difference in job qualities
- CSAT score: imputed based on college major and location

	Initial		Follow-up	
	Male	Female	Male	Female
In the labor force (%):	78.47	75.71	88.64	81.97
Employed among LF participants(%)	96.07	95.40	86.10	84.79
Among those employed:				
- Monthly Earnings (10,000 2010 won)	244.00	192.65	280.26	217.64
- Regular position (%)	83.14	73.90	90.27	84.79
Among regular position (%):				
- Working at a large-scale firm	47.24	30.99	48.00	31.66
CSAT score (standardized)	-0.07	0.09	-0.07	0.10

College Major and Employment: Follow-up Survey

- Marginal effects reported, Engineering(omitted)
- Controls: gender, CSAT, age, age-sq, dummies for college major, marital status, year, and region.

Dep. variable	1: Labor Force	1: Employed	1: Regular workers
Sample	All	LF	Employees
- Humanities	-0.057***	-0.020**	-0.097***
	(0.008)	(0.007)	(0.010)
- Social Science	-0.023***	-0.010	-0.023***
	(0.006)	(0.006)	(0.007)
- Education	0.015*	-0.007	-0.034***
	(0.007)	(0.008)	(0.010)
- Science	-0.054***	-0.051***	-0.076***
	(0.007)	(0.007)	(0.009)
- Medicine/Health	0.046***	0.003	-0.139***
	(0.009)	(0.010)	(0.016)
- Arts/Athletics	-0.034***	-0.115***	-0.129***
	(0.008)	(0.010)	(0.013)

College Major and Employment: Follow-up Survey

- Marginal effects reported
- Gender gap in likelihood of being employed, and being a regular worker

Dep. variable	1: Labor Force	1: Employed	1: Regular workers
Sample	All	LF	Employees
A. without college major			
Female	-0.051***	-0.022***	-0.048***
	(0.005)	(0.005)	(0.006)
B. with college major			
Female	-0.044***	-0.013**	-0.026***
	(0.005)	(0.005)	(0.005)

College Major and Earnings

- Omitted major: engineering
- Controls: gender, CSAT, age, age-sq, dummies for college major, marital status, year, and region.

College major	log(earnings) Initial survey	log(earnings) Follow-up	△ log(earnings) Both surveys
No. of observations	30,242	24,767	22,717
- Humanities	-0.207***	-0.195***	0.010
	(0.009)	(0.009)	(0.009)
- Social Science	-0.048***	-0.058***	-0.012
	(0.007)	(0.007)	(0.007)
- Education	-0.049***	-0.104***	-0.060***
	(0.011)	(0.010)	(0.010)
- Science	-0.151***	-0.115***	0.036***
	(0.009)	(0.008)	(0.008)
- Medicine/Health	0.134***	0.101***	-0.003
	(0.013)	(0.013)	(0.013)
- Arts/Athletics	-0.329***	-0.303***	0.011
	(0.010)	(0.010)	(0.010)

College Major and Earnings

- Significant and widening gender gap in monthly earnings
- College major accounts for over 24% of the gap, but not much of the growth rate.

	log(earnings) Initial survey	log(earnings) Follow-up	△ log(earnings) Both surveys
A. without college major			
Female	-0.121***	-0.191***	-0.052***
	(0.008)	(0.007)	(0.008)
CSAT	0.081***	0.067***	-0.015***
	(0.003)	(0.003)	(0.003)
B. with college major			
Female	-0.078***	-0.146***	-0.050***
	(0.008)	(0.007)	(0.008)
CSAT	0.078***	0.069***	-0.009***
	(0.003)	(0.003)	(0.003)

Robustness Check:

- Excluding Arts/Athletics
  - Findings hold qualitatively
- Exogeneity conditional on high-school track choice
  - Subsample analysis: humanities/social science vs. math/science
  - Findings hold qualitatively
- Imputed CSAT score vs. actual CSAT
  - KEEP
  - Imputed CSAT generates results comparable to those based on actual CSAT

Policy Implications: Follow-up survey

- Scenario 1: decrease quotas of all other major by 10%,
  but increase quota of Engineering major (27% to 35%)
  - LMP ↑ by 0.2% pts.
  - Employment rate ↑ by 0.2% pts.
  - Chance of having a egular position ↑ by 0.5% pts.
- Scenario 2: women's major choice = men's
  - Female LMP ↑ by 0.6% pts.
  - Female employment rate ↑ by 1.1% pts.
  - Female's chance of having a regular position ↑ by 2.5% pts.

Conclusions

- College major
  - Matters in earnings, employment, employment quality
  - Accounts for a significant portion of gender gap in labor market outcomes
- Future research
  - Efficient policy designs:
    e.g., allocation of college major quota, incentives
  - Need to understand determinants of college majors:
    potentially effective policy tools to reduce the gender gap

Thank you!

College Major and Employment: Initial Survey

- Marginal effects reported, Engineering(omitted)
- Controls: gender, CSAT, age, age-sq, dummies for college major, marital status, year, and region.

Dep. variable	1: Labor Force	1: Employed	1: Regular workers
Sample	All	LF	Employees
- Humanities	-0.022**	-0.026***	-0.135***
	(0.007)	(0.005)	(0.010)
- Social Science	0.006	-0.019***	0.033***
	(0.006)	(0.004)	(0.008)
- Education	0.007	-0.004	-0.043***
	(0.008)	(0.005)	(0.011)
- Science	-0.069***	-0.036***	-0.095***
	(0.007)	(0.006)	(0.010)
- Medicine/Health	0.099***	-0.033***	-0.113**
	(0.009)	(0.008)	(0.015)
- Arts/Athletics	0.031***	-0.149***	-0.183***
	(0.008)	(0.012)	(0.012)

College Major and Employment: Initial Survey

- Marginal effects reported
- Gender gap in likelihood of being employed, and being a regular worker

Dep. variable	1: Labor Force	1: Employed	1: Regular workers
Sample	All	LF	Employees
A. without college major			
Female	0.021***	-0.018***	-0.028***
	(0.006)	(0.003)	(0.007)
B. with college major			
Female	0.022***	-0.009***	-0.004
	(0.006)	(0.002)	(0.007)