

Human Capital Investments and Expectations about Career and Family

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Summary I

Research questions and design

- What do students believe about the consequences of their education choices?
- How do students sort into majors?
- Novel: what role do family variables play in such choices?
- Survey with undergraduate students at NYU on perceptions about consequences of educational choices
- Specifically: choice of a major
- Follow-up survey after six years

Summary II

Results

- Students believe in importance of consequences for own earnings and family life
- Particularly women, major choice also corresponds to different rates and timing of marriage and fertility
- Belief about marriage market "return" to higher earning majors
- Ex-ante beliefs are systematically related to educational choices and ex-post realized outcomes

Model I

Human capital investment under uncertainty

- Expected utility for human capital choice at time τ :

$$E_{i,\tau}(V_k) = \sum_{t=\tau+1}^T \beta^{t-\tau} \int u_t(X) dG_{i,\tau}(X|k, t)$$

- with discount rate *beta* and outcome X for all subsequent periods given a human capital investment k
- $G_{i,\tau}(X|k, t)$ is the belief distribution about the outcome given human capital investments k

Model II

Belief distribution $G_{i,\tau}(X|k, t)$

- Survey design elicits beliefs $G_{i,\tau}(X|k, t)$ about the choice of a major
- Belief distributions have four characteristics:
 - reflect individual *uncertainty*
 - are *heterogenous*
 - can be *incorrect*
 - can evolve over time due to *learning*
- Natural limitation: elicitation of degree of uncertainty

Model III

Different effects of human capital choices

- Ex-ante individual differences in beliefs

$$\Delta_{G,i}(k, k') = G_i(X|k, t) - G_i(X|k', t)$$

- Ex-post individual differences in potential outcomes

$$\Delta_{F,i}(k, k') = F_i(X|k, t) - F_i(X|k', t)$$

- Ex-post individual differences realized outcomes

$$\Delta_H(k, k') = H(X|k, t) - H(X|k', t)$$

with $H(X|k, t) = \frac{1}{M_k} \sum_{t \in \Omega_k} F_i(k = k^*, t)$

Data

- Survey among NYU undergraduate students in 2010
- Beliefs about earnings, earnings growth, earnings uncertainty, marriage, spousal earnings, fertility and labor supply
- Questions conditioned on ages 23, 30 and 45
- Sample consists of 493 individuals
- Follow-up survey 6 years later

Current Population Characteristics I

- Earnings, employment, and marriage data for the US population using the 2009
- Not suited for causal inference; needs not reflect the student's beliefs
- Data from older cohort; includes not only high-ability participants
- But data is suited to document that career and family outcomes differ by educational choices in observational data

Earnings Beliefs

Earnings Levels

- Male students believe to earn more than female students at each age
- All students believe to see rapid growth in earnings
- Students believe to see substantially smaller earning growth if they don't major in science/business
- Perceived gender gap is largest in science/business and at later stages

Earnings Beliefs

Earnings Returns and Earnings Growth

- Should I make go more into details here?

Beliefs about Marriage and Spousal Characteristics

- Recent theory predicts that investment in education generates returns in the marriage market
- Probabilities:
 - Women believe they are slightly more likely to be married at younger ages, but no difference at age 45
 - Students believe they are less likely to be married without a degree
- Potential Spouse's Earnings
 - Men expect lower, women expect higher earnings for their potential Spouse
 - Students believe graduating in science or business relative to humanities or no degree will result in a higher earning spouse
 - There is evidence for assortative mating by education

Beliefs about Fertility

- Conditioned on ages 30 and 45
- Men and women believe that completing a science or business degree rather than a degree in the humanities would reduce their expected number of children at age 30
- In contrast, completing a degree relative to no degree doubles expected number of children
- Students believe major choice has a larger effect on the timing of fertility rather than on the level

Beliefs about Future Labor Supply

- Students believe their human capital choice will substantially affect their future employment
- Beliefs about working full-time is higher for males and higher for science/business degree relative to a degree in humanities
- Students' beliefs about their age 30 labor supply conditional on future expected marital status:
- Male students beliefs about future labor supply vary little by marital status, female students believe to work less when married

Beliefs and Human Capital Choices I

- Do beliefs actually influence intended and actual decisions?
- Intended major and actual major are outcome variables in the analysis

Beliefs and Human Capital Choices II

Females

Table 14: (Intended and Actual) Major Choice and Expectations about Career and Family

	Intended Major				Actual Major	
	OLS		LAD		Multinomial Logit	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Females						
Age 30 Earnings (\$10,000s)	0.146*** (0.047)	0.099** (0.048)	0.230*** (0.065)	0.183** (0.078)	0.084*** (0.019)	0.037 (0.026)
Ability Rank	0.029*** (0.004)	0.029*** (0.004)	0.035*** (0.005)	0.039*** (0.004)	0.021*** (0.004)	0.022*** (0.004)
Prob Marriage by Age 30		-0.251 (0.706)		-0.171 (0.713)		1.444** (0.690)
Spousal Earnings (\$10,000s)		0.087*** (0.028)		0.083 (0.059)		0.110*** (0.036)
Exp num of children by 30		0.306** (0.188)		0.603*** (0.202)		0.575*** (0.143)
Constant	-1.473*** (0.206)	-1.266*** (0.250)	-1.445*** (0.188)	-0.878*** (0.262)		
Pvalue (Family variables) ^a		0.0124		0.0088		0.000
Number of Individuals	317	317	317	317	185	185
Observations	634	634	634	634	555	555
(Pseudo) R-squared	0.192	0.219	0.1323	0.1484	0.157	0.2399

Cols (1)-(2) show OLS estimates. Cols (3)-(4) show Least Absolute Deviation estimates. The dep. variable is the intended likelihood of choosing a major.

Cols (5)-(6) show estimates from a multinomial logit regression, where the dependent variable is the actual major at graduation.

Robust standard errors in parentheses. ** p<0.01, * p<0.05, * p<0.1.

^a P-value of a F-test that coefficients on prob of marriage, spousal earnings, and exp number of children are jointly zero.

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	OLS		LAD		Multinomial	Logit
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Males						
Age 30 Earnings (\$10,000s)	0.095*** (0.026)	0.093*** (0.026)	0.105** (0.047)	0.102** (0.051)	0.407*** (0.074)	0.410*** (0.080)
Ability Rank	0.024*** (0.005)	0.025*** (0.005)	0.018*** (0.006)	0.018*** (0.006)	0.002 (0.006)	0.002 (0.007)
Prob Marriage by Age 30		0.704 (1.049)		1.513 (1.517)		0.569 (1.383)
Spousal Earnings (\$10,000s)		0.029 (0.029)		0.018 (0.081)		-0.010 (0.046)
Exp num of children by 30		0.202 (0.234)		0.242 (0.225)		0.211 (0.234)
Constant	-0.423* (0.235)	-0.243 (0.290)	-0.178 (0.138)	-0.018 (0.223)		
Pvalue (Family variables) ^a		0.5248		0.6978		0.8005
Number of Individuals	176	176	176	176	88	88
Observations	352	352	352	352	264	264
(Pseudo) R-squared	0.159	0.167	0.0744	0.0803	0.39	0.3953

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Beliefs and Realized Outcomes I

Follow-up survey

- Follow-up survey six years after the initial survey
- 274 out of the initial 493 respondents participated
- Average age of respondent is 25
- Provides some evidence for the "quality" of the expectations data
- Respondents are not reminded of their initial answers

Beliefs and Realized Outcomes II

Population descriptive statistics

- No statistically significant differences for earnings: expected \$73.500 vs \$74.900 and working full-time
- working part-time: 18% of females expected to work part-time, but only 9% in reality
- Large significant differences for likelihood of marriage

Beliefs and Realized Outcomes III

Individual-level relationship - career

Table 16: The Link between Expectations and Outcomes

	All	Males	Females
Panel A, dependent variable: Log (current earnings) Log(Exp Earnings, Age Weighted)	0.386*** (0.131)	0.167 (0.207)	0.521*** (0.125)
Observations	201	64	137
R^2	0.092	0.018	0.153
Mean of Dependent Variable	10.99	11.18	10.90
Panel B, dependent variable: Employed Full-time Expected Prob of full-time emp at 30	0.165 (0.148)	-0.189 (0.220)	0.358* (0.187)
Observations	273	88	185
R^2	0.005	0.007	0.023
Mean of Dependent Variable	0.740	0.740	0.740
Panel C, dependent variable: Employed Part-time Expected Prob of part-time Emp at 30	0.272* (0.161)	0.0203 (0.263)	0.392** (0.196)
Observations	273	88	185
R^2	0.015	0.000	0.032
Mean of Dependent Variable	0.0900	0.0900	0.0900

Beliefs and Realized Outcomes III

Individual-level relationship - career

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R^2	0.015	0.000	0.032
Mean of Dependent Variable	0.0900	0.0900	0.0900

Beliefs and Realized Outcomes IV

Individual-level relationship - family variables

- Marriage variable is distorted due to young age of respondents
- Significant if approximated by actual outcome "in a relationship"
- Beliefs about spousal income are predictive for actual spousal income
- Overall beliefs compare favorably to actual outcomes
- Indication that students can anticipate career and family outcomes of educational choices to some degree

Future Research

- Run follow-up surveys when students realize outcomes at ages 30 and 45
- Choice of participants casts doubt on external validity: extend the Sample
- Study elicits student's beliefs, but does not uncover the reasons for these beliefs
- Stated beliefs are not consequential

Current Population Characteristics II

Table 2: Descriptive Statistics of 2009 ACS Data

	Age 23		Age 30		Age 45	
	Male	Female	Male	Female	Male	Female
Earnings (in \$10,000s)						
Science/Business	3.33 (2.15)	3.22 (2.19)	6.74 (4.81)	5.48+++ (3.15)	11.61 (9.79)	7.46+++ (6.49)
Humanities	2.51 (1.33)	2.57 (1.88)	5.40 (4.20)	4.47+++ (2.71)	9.07 (8.48)	5.93+++ (5.67)
No Degree	2.54 (1.52)	2.15+++ (1.41)	4.21 (2.50)	3.08+++ (1.59)	5.70 (4.13)	3.88+++ (2.57)
p-value ^a	0	0	0	0	0	0
Spousal Earnings (in \$10,000s)						
Science/Business	3.41 (2.09)	4.75+++ (3.11)	5.26 (3.44)	8.25+++ (5.79)	7.44 (6.69)	12.68+++ (10.15)
Humanities	2.27 (1.33)	3.49+++ (1.93)	4.30 (2.61)	6.66+++ (5.64)	5.71 (4.72)	9.85+++ (9.42)
No Degree	2.21 (1.13)	3.50+++ (1.93)	3.24 (1.86)	4.82+++ (2.92)	3.76 (2.59)	6.36+++ (4.81)
p-value	0	0.003	0	0	0	0
Full-time Employed (%)						
Science/Business	38.5	42.4+++	80.86	64.40+++	82.68	58.42+++
Humanities	30.9	36.2+++	72.96	57.92+++	75.86	52.07+++
No Degree	40.1	34.4+++	66.53	46.51+++	67.88	52.44+++
p-value	0	0	0	0	0	0
Married (%)						
Science/Business	8.2	15.9+++	61.72	67.49+++	80.79	76.14+++
Humanities	11.5	15.3+++	55.7	64.94+++	76.58	74.51+
No Degree	15.2	26.4+++	54.86	59.29+++	69.3	69.65
p-value	0	0	0	0	0	0

Earnings and spousal earnings shown in \$10,000s.

Mean (standard deviation) shown for the continuous outcomes.

+++, ++, + gender differences statistically significant at the 1, 5, and 10% levels, respectively. Symbols denoted on female column.

^a p-value of a F-test of the joint equality of means across majors. p-value of zero implies p-value < 0.001.

Earnings Beliefs: Earnings Levels

Table 3: Self Earnings

	Age 23		Age 30		Age 45	
	Male	Female	Male	Female	Male	Female
Panel A: Levels (in 10,000s of dollars)						
Science/Business	5.93 (7.32)	5.39 (4.66)	13.74 (16.61)	10.86++ (9.31)	19.00 (22.38)	13.81+++ (14.12)
Humanities	4.71 (7.38)	3.94 (3.51)	6.87 (5.51)	6.86 (7.4)	11.03 (13.53)	9.60 (11.75)
No Degree	3.50 (7.54)	2.45++ (1.16)	5.07 (11.0)	3.27++ (4.56)	8.97 (15.95)	5.86+++ (10.22)
Overall	5.60 (7.36)	4.68+ (3.81)	12.95 (16.35)	9.21+++ (8.45)	18.44 (22.52)	12.33+++ (13.90)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	.267*** (.019)	.304*** (.017)	.523*** (.048)	.425***++ (.025)	.446*** (.051)	.347***+ (.026)
Graduate versus. No Degree	.594*** (.033)	.642*** (.026)	1.022*** (.055)	1.038*** (.037)	.829*** (.054)	.833*** (.038)

Panel A shows the mean and standard deviations of expected earnings (in \$10,000s). +++, ++, + denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Panel B shows the avg. log differences and standard deviations in parentheses. ***, **, * denote the means are statistically different from zero at the 1, 5, and 10% levels, respectively. +++, ++, + (shown on the female column) denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Earnings Growth

Table 4: Earnings growth beliefs

	Age 23-30		Age 30-45	
	Male	Female	Male	Female
Panel A: Levels (in %)				
Science/Business	.67 (.72)	.63 (.65)	.25 (.47)	.19 (.54)
Humanities	.41 (.56)	.51+ (.53)	.32 (.45)	.27 (.52)
No Degree	.23 (.78)	.21 (.55)	.47 (.74)	.43 (.58)
Overall	.66 (.73)	.6 (.58)	.29 (.48)	.23 (.52)
Panel B: Individual differences				
Sci/Business versus. Humanities	.26*** (.05)	.12***+++ (.03)	-.08* (.04)	-.08*** (.03)
Graduate versus. No Degree	.42*** (.06)	.39*** (.03)	-.19*** (.06)	-.2*** (.03)

Panel A shows the mean and standard dev of beliefs about earnings growth (in %).

+++, ++, + denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Panel B shows average log differences and standard deviations in parentheses.

***, **, * denote means are statistically different from zero at the 1, 5, and 10% levels, respectively. +++, ++, + (shown on the female column) denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Earnings Uncertainty

Table 5: Age 30 Earnings Uncertainty - Std deviations from fitting a Beta Distribution

	Male	Female
Panel A: Levels (in \$10,000)		
Science/Business	9.17 (1.44)	9.49 (2.48)
Humanities	10.34 (27.44)	10.01 (2.32)
No Degree	14.73 (7.34)	15.27 (7.53)
Overall	9.71 (2.02)	9.68 (2.01)
Panel B: Individual differences		
Sci/Business versus. Humanities	-.11*** (.014)	-.057***+++ (.012)
Graduate versus. No Degree	-.305*** (.052)	-.335*** (.043)

Panel A shows the mean and std dev of age 30 earnings uncertainty beliefs (in \$10,000). Uncertainty is the standard deviation of the individual-specific (beta-) fitted earnings distribution. +++, ++, + denote gender differences statistically different at the 1, 5, and 10% levels, respectively.

Panel B shows average log differences and standard deviations in parentheses. ***, **, * denote means are statistically diff from 0 at the 1, 5, and 10% levels, respectively. +++, ++, + (shown on female column) denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Beliefs about Marriage

Table 6: Beliefs about Marriage

Prob Marriage:	Age 23		Age 30		Age 45	
	Male	Female	Male	Female	Male	Female
Panel A: Levels (0-1 scale)						
Science/Business	.148 (.207)	.167 (.214)	.593 (.286)	.594 (.271)	.804 (.248)	.778 (.253)
Humanities	.152 (.214)	.182 (.229)	.601 (.291)	.66++ (.268)	.797 (.253)	.800 (.246)
No Degree	.153 (.219)	.221+++ (.26)	.535 (.329)	.605++ (.29)	.727 (.302)	.743 (.287)
Overall	.149 (.213)	.179 (.225)	.589 (.288)	.634+ (.266)	.797 (.25)	.793 (.242)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	-.008 (.046)	-.096* (.053)	-.024 (.042)	-.147***++ (.039)	.013 (.014)	-.020 (.024)
Graduate versus. No Degree	.075 (.099)	-.192**+ (.091)	.354*** (.11)	.127***++ (.054)	.317*** (.09)	.161*** (.054)

Panel A shows the mean and standard deviations of marriage beliefs. +++, ++, + denote gender diffs are statistically significant at the 1, 5, and 10% levels, respectively.

Panel B shows the average log differences and standard deviations in parentheses.

***, **, * denote the means are statistically different from zero at the 1, 5, and 10% levels, respectively. +++, ++, + (shown on the female column) denote gender differences are statistically significant at the 1, 5, and 10% levels, respectively.

Beliefs about Potential Spousal Earnings

Table 7: Beliefs about Potential Spousal Earnings, Conditional on Own Major (and Own Age)

	Age 23		Age 30		Age 45	
	Male	Female	Male	Female	Male	Female
Panel A: Levels (in 10,000s of dollars)						
Science/Business	5.06 (4.12)	5.74+ (3.92)	9.00 (7.72)	10.76++ (9.14)	11.29 (13.25)	13.68+ (13.67)
Humanities	4.52 (7.35)	4.75 (3.75)	7.05 (8.93)	7.86 (7.69)	8.02 (7.95)	11.07+++ (12.90)
No Degree	4.58 (11.99)	3.46 (2.26)	4.57 (5.56)	5.54 (9.11)	6.25 (9.89)	7.76 (12.03)
Overall	5.02 (5.90)	5.30 (3.88)	8.42 (7.60)	9.74+ (8.91)	10.77 (13.20)	12.73 (13.61)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	.185*** (.019)	.198*** (.015)	.282*** (.044)	.292*** (.024)	.241*** (.04)	.221*** (.026)
Graduate versus. No Degree	.432*** (.048)	.481*** (.028)	.687*** (.05)	.741*** (.041)	.587*** (.054)	.632*** (.039)

Panel A shows the mean and standard dev of beliefs about spouse's expected earnings (in \$10,000s) conditional on own major.

+++, ++, + denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Panel B shows avg. log differences and standard deviations in parentheses. ***, **, * denote means are statistically different from zero at the 1, 5, and 10% levels, respectively. ++, + (shown on the female column) denote gender differences are statistically different at the 1, 5, and 10% levels, respectively.

Beliefs and Realized Outcomes

Population statistics - career variables

Table 15: Descriptive Statistics - Expectations (Weighted by Major Probs) and Outcomes

	Expectations in 2010			Realizations in 2016		
	All	Males	Females	All	Males	Females
Panel A: Earnings Full-time (age-weighted expectation)						
Mean	7.35	9.90	6.16	7.49	10.18	6.24
SD	(8.19)	(13.52)	(3.06)	(7.74)	(12.39)	(3.46)
N	201	64	137	201	64	137
Panel B: Likelihood of full-time employment (age 30 expectation)						
Mean	77.61	82.28	75.38	73.99	73.86	74.05
SD	(19.15)	(19.51)	(18.61)	(43.95)	(44.19)	(43.95)
N	273	88	185	273	88	185
Panel C: Likelihood of part-time employment (age 30 expectation)						
Mean	16.02***	11.71	18.08***	9.16	9.09	9.19
SD	(13.1)	(12.02)	(13.12)	(28.9)	(28.91)	(28.97)
N	273	88	185	273	88	185

Beliefs and Realized Outcomes

Population statistics - family variables

Table 15: Descriptive Statistics - Expectations (Weighted by Major Probs) and Outcomes

	Expectations in 2010			Realizations in 2016		
	All	Males	Females	All	Males	Females
Panel D: Likelihood of Marriage						
Using expectation for 1-yr after graduation (and marriage for outcomes)						
Mean	16.04***	13.62*	17.16***	5.56	8.14	4.35
SD	(21.62)	(19.83)	(22.37)	(22.95)	(27.5)	(20.45)
N	270	86	184	270	86	184
Using age-weighted expectation (and marriage + cohab. for outcomes)						
Mean	34.36***	31.35***	35.77***	48.15	45.35	49.46
SD	(21.08)	(21.97)	(20.56)	(50.06)	(50.08)	(50.13)
N	270	86	184	270	86	184
Panel E: Likelihood of partner working full-time (age 30 expectation)						
Mean	73.91	62.28	78.89	76.15	69.23	79.12
SD	(21.19)	(23.28)	(18.2)	(42.78)	(46.76)	(40.87)
N	130	39	91	130	39	91
Panel F: Partner's Earnings (age-weighted expectation)						
Mean	6.52*	6.84	6.4**	7.73	5.68	8.5
SD	(2.84)	(3.24)	(2.69)	(6.14)	(3.53)	(6.73)
N	99	27	72	99	27	72

Beliefs and Realized Outcomes

Individual-level relationship - family variables

Table 16: The Link between Expectations and Outcomes

	All	Males	Females
Panel D, dependent variable: Married			
Age-Weighted Exp Probability of Being Married	0.217** (0.100)	0.378* (0.217)	0.147 (0.0936)
Observations	270	86	184
R^2	0.040	0.091	0.022
Mean of Dependent Variable	0.0600	0.0800	0.0400
Panel E, dependent variable: In Any relationship			
Age-Weighted Exp Probability of Being Married	0.503*** (0.127)	0.606*** (0.209)	0.441*** (0.161)
Observations	270	86	184
R^2	0.045	0.071	0.033
Mean of Dependent Variable	0.480	0.450	0.490
Panel F, dependent variable: Spouse/Partner Working Full-time			
Expected Prob of Spouse full-time Emp at 30	0.415** (0.183)	0.458 (0.298)	0.339 (0.253)
Observations	130	39	91
R^2	0.042	0.052	0.023
Mean of Dependent Variable	0.760	0.690	0.790
Panel G, dependent variable: Log(Spouse/Partner Earnings)			
Log(Age-Weighted Expected Earnings of Spouse)	0.400** (0.173)	0.598** (0.233)	0.344* (0.206)
Observations	112	31	81
R^2	0.054	0.119	0.042
Mean of Dependent Variable	1.690	1.420	1.790