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 distrubtions 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 ask Jogibär if put here; also how do they elicit?

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 belief 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***	0.099**	0.230***	0.183**	0.084***	0.037
	(0.047)	(0.048)	(0.065)	(0.078)	(0.019)	(0.026)
Ability Rank	0.029***	0.029***	0.035***	0.039***	0.021***	0.022***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Prob Marriage by Age 30		-0.251		-0.171		1.444**
		(0.706)		(0.713)		(0.690)
Spousal Earnings ($10,000s)		0.087***		0.083		0.110***
		(0.028)		(0.059)		(0.036)
Exp num of children by 30		0.306*		0.603***		0.575***
		(0.188)		(0.202)		(0.143)
Constant	-1.473***	-1.266***	-1.445***	-0.878***		
	(0.206)	(0.250)	(0.188)	(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 coefficeints on prob of marriage, spousal earnings, and exp number of children are jointly zero.

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	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Males						
Age 30 Earnings ($10,000s)	0.095***	0.093***	0.105**	0.102**	0.407***	0.410***
	(0.026)	(0.026)	(0.047)	(0.051)	(0.074)	(0.080)
Ability Rank	0.024***	0.025***	0.018***	0.018***	0.002	0.002
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Prob Marriage by Age 30		0.704		1.513		0.569
		(1.049)		(1.517)		(1.383)
Spousal Earnings ($10,000s)		0.029		0.018		-0.010
		(0.029)		(0.081)		(0.046)
Exp num of children by 30		0.202		0.242		0.211
		(0.234)		(0.225)		(0.234)
Constant	-0.423*	-0.243	-0.178	-0.018		
	(0.235)	(0.290)	(0.138)	(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 in expectations for earnings and working full-time
- 18% of females expected to work part-time, but only 9% in reality
- Large significant differences in expectations about marriage
- Significant difference in females expectations about partner's earnings: expectation 64.000 vs. realization 85.000

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***	0.167	0.521***
	(0.131)	(0.207)	(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	-0.189	0.358*
	(0.148)	(0.220)	(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*	0.0203	0.392**
	(0.161)	(0.263)	(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

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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	3.22	6.74	5.48+++	11.61	7.46+++
	(2.15)	(2.19)	(4.81)	(3.15)	(9.79)	(6.49)
Humanities	2.51	2.57	5.40	4.47+++	9.07	5.93+++
	(1.33)	(1.88)	(4.20)	(2.71)	(8.48)	(5.67)
No Degree	2.54	2.15+++	4.21	3.08+++	5.70	3.88+++
	(1.52)	(1.41)	(2.50)	(1.59)	(4.13)	(2.57)
p-value[a]	0	0	0	0	0	0
Spousal Earnings (in $10,000s)						
Science/Business	3.41	4.75+++	5.26	8.25+++	7.44	12.68+++
	(2.09)	(3.11)	(3.44)	(5.79)	(6.69)	(10.15)
Humanities	2.27	3.49+++	4.30	6.66+++	5.71	9.85+++
	(1.33)	(1.93)	(2.61)	(5.64)	(4.72)	(9.42)
No Degree	2.21	3.50+++	3.24	4.82+++	3.76	6.36+++
	(1.13)	(1.93)	(1.86)	(2.92)	(2.59)	(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-vlaue < 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	5.39	13.74	10.86++	19.00	13.81+++
	(7.32)	(4.66)	(16.61)	(9.31)	(22.38)	(14.12)
Humanities	4.71	3.94	6.87	6.86	11.03	9.60
	(7.38)	(3.51)	(5.51)	(7.4)	(13.53)	(11.75)
No Degree	3.50	2.45++	5.07	3.27++	8.97	5.86+++
	(7.54)	(1.16)	(11.0)	(4.56)	(15.95)	(10.22)
Overall	5.60	4.68+	12.95	9.21+++	18.44	12.33+++
	(7.36)	(3.81)	(16.35)	(8.45)	(22.52)	(13.90)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	.267***	.304***	.523***	.425***++	.446***	.347***+
	(.019)	(.017)	(.048)	(.025)	(.051)	(.026)
Graduate versus. No Degree	.594***	.642***	1.022***	1.038***	.829***	.833***
	(.033)	(.026)	(.055)	(.037)	(.054)	(.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	.63	.25	.19
	(.72)	(.65)	(.47)	(.54)
Humanities	.41	.51+	.32	.27
	(.56)	(.53)	(.45)	(.52)
No Degree	.23	.21	.47	.43
	(.78)	(.55)	(.74)	(.58)
Overall	.66	.6	.29	.23
	(.73)	(.58)	(.48)	(.52)
Panel B: Individual differences				
Sci/Business versus. Humanities	.26***	.12***+++	-.08*	-.08***
	(.05)	(.03)	(.04)	(.03)
Graduate versus. No Degree	.42***	.39***	-.19***	-.2***
	(.06)	(.03)	(.06)	(.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	9.49
	(1.44)	(2.48)
Humanities	10.34	10.01
	(27.44)	(2.32)
No Degree	14.73	15.27
	(7.34)	(7.53)
Overall	9.71	9.68
	(2.02)	(2.01)
Panel B: Individual differences		
Sci/Business versus. Humanities	-.11***	-.057***+++
	(.014)	(.012)
Graduate versus. No Degree	-.305***	-.335***
	(.052)	(.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	.167	.593	.594	.804	.778
	(.207)	(.214)	(.286)	(.271)	(.248)	(.253)
Humanities	.152	.182	.601	.66++	.797	.800
	(.214)	(.229)	(.291)	(.268)	(.253)	(.246)
No Degree	.153	.221+++	.535	.605++	.727	.743
	(.219)	(.26)	(.329)	(.29)	(.302)	(.287)
Overall	.149	.179	.589	.634+	.797	.793
	(.213)	(.225)	(.288)	(.266)	(.25)	(.242)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	-.008	-.096*	-.024	-.147***++	.013	-.020
	(.046)	(.053)	(.042)	(.039)	(.014)	(.024)
Graduate versus. No Degree	.075	-.192**+	.354***	.127**++	.317***	.161***
	(.099)	(.091)	(.11)	(.054)	(.09)	(.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	5.74+	9.00	10.76++	11.29	13.68+
	(4.12)	(3.92)	(7.72)	(9.14)	(13.25)	(13.67)
Humanities	4.52	4.75	7.05	7.86	8.02	11.07+++
	(7.35)	(3.75)	(8.93)	(7.69)	(7.95)	(12.90)
No Degree	4.58	3.46	4.57	5.54	6.25	7.76
	(11.99)	(2.26)	(5.56)	(9.11)	(9.89)	(12.03)
Overall	5.02	5.30	8.42	9.74+	10.77	12.73
	(5.90)	(3.88)	(7.60)	(8.91)	(13.20)	(13.61)
Panel B: Individual Log Differences						
Sci/Business versus. Humanities	.185***	.198***	.282***	.292***	.241***	.221***
	(.019)	(.015)	(.044)	(.024)	(.04)	(.026)
Graduate versus. No Degree	.432***	.481***	.687***	.741***	.587***	.632***
	(.048)	(.028)	(.05)	(.041)	(.054)	(.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**	0.378*	0.147
	(0.100)	(0.217)	(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***	0.606***	0.441***
	(0.127)	(0.209)	(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**	0.458	0.339
	(0.183)	(0.298)	(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**	0.598**	0.344*
	(0.173)	(0.233)	(0.206)
Observations	112	31	81
R^2	0.054	0.119	0.042
Mean of Dependent Variable	1.690	1.420	1.790