

Skill-related Job Preferences of University Students

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Motivation

Digital transformation is changing the skills required in different jobs
(e.g. Autor et al. 2003, Deloitte 2017, Deming/Kahn 2018, OECD 2019)

- Demand for skills substitutable by digital technologies
 - ▶ Skills needed for routine tasks
- Demand for skills complementary to digital technologies
 - ▶ IT skills
 - ▶ Non-cognitive skills (e.g. communication, organisation, decision-making)
- Increasing returns to complementary skills:
 - ▶ IT skills (Falck et al. 2021)
 - ▶ social skills (Deming 2017; Edin et al. 2022)
 - ▶ leadership skills (Edin et al. 2022)

How does labour supply respond to these developments?

Objectives of our study

Measure skill-related labour supply preferences:

- social, management and digital skills:
key competencies in the digital age
- university students:
increasingly important group of skilled labour market entrants
- preference heterogeneity
- relationship with own skills and actual job choices

Relevance:

- improve understanding of occupational choices
- mitigate risk of skill mismatch and inefficient labour market outcomes

Choice of methodology

Inferring skill-related job preferences from actual job choices is challenging:

- labour market inefficiencies may prevent optimal choices
- full set of alternatives is unobserved by the researcher
- full set of actual job characteristics is unobserved by the researcher
- selection into different jobs and unobserved heterogeneity

Our approach: hypothetical choice experiment

(Wiswall and Zafar, QJE 2018)

- hypothetical job offers with exogenously manipulated job attributes
- express preferences in an economically interpretable willingness to pay (WTP)
- within-person design to elicit individual WTP

Contribution and related literature

Experimentally elicited job preferences (stated choice experiments):

- Working time, job flexibility, job security, bonuses (e.g. Mas/Pallais 2017, Wiswall/Zafar 2018, Datta 2019, Valet et al. 2021), fringe benefits (Eriksson/Kristensen 2014), gender diversity (Wiswall/Zafar 2018, LaViers/Sandvik 2022)
- Gender-typical job tasks (Gelblum 2020)

Gender differences in job tasks/used skills and occupational sorting/pay gap (observational studies):

- Gender disparities in performing object- and people-related tasks (Stinebrickner et al. 2018, Kuhn/Wolter 2022)
- Gender disparities in using various skills (Peto/Reizer 2021, Chen/Luo 2022)

Our contribution:

- First experimental evidence on skill-related job preferences of university students
- Role of own perceived skills (and actual skills, in progress)
- Skill complementarities (in progress)
- Relationship to actual job choices (in progress)

Experimental setting

Setting:

- part of biannual online survey of students at University of Basel 2021-2024
- experiment in fall 2022 / spring 2023 / fall 2023
- 469 master and PhD students from all faculties participated

Experimental design:

- based on the design of Wiswall/Zafar (QJE 2018)
- exogenously vary 7 different job attributes
- 16 scenarios à 3 jobs (i.e. 48 observations/person)
- 2 blocks à 8 scenarios
- random order of scenarios within block
- within-subject design: all participants respond to all scenarios

Experimental design

Attributes and levels

Table 1: Attributes and their levels

Attributes	Attribute levels
1 Annual gross salary 5 years after job take-up (for full-time)	Various levels in the range of 73,000 - 160,000 CHF
2 Part-time option available	Yes / No
3 Work hours per week (on average, for full-time)	Various levels in the range of 38 - 53 hours
4 Positive job growth	Yes / No
5 Importance of social skills	Less important / Relatively important
6 Importance of digital skills	Less important / Relatively important
7 Importance of management skills	Less important / Relatively important





Notes: Table presents the job attributes and their levels used in the experimental scenarios.

► Choice of job attribute values

We eliminate scenarios with a dominant job or insufficient variation in job attributes across jobs.





Experimental design

Example for scenario in block A

	JOB 1	JOB 2	JOB 3
 Annual gross salary 5 years after job take-up (if working full time)	94'000 CHF	73'000 CHF	85'000 CHF
 Part-time work is possible i.e. a work-time percentage below 90% is an option	No	Yes	Yes
 Work hours per week on average, for full-time	47	40	50
 Positive job growth i.e. an increase in vacancies in the job in recent years	Yes	Yes	No

Experimental design

Example for scenario in block B

	JOB 1	JOB 2	JOB 3
 Annual gross salary 5 years after job take-up (if working full time)	106'000 CHF	100'000 CHF	97'000 CHF
 Importance of Social skills for the exercise of the job <i>Examples: Communicating, working with others, networking, advising, negotiating, presenting information</i>	Relatively important	Relatively important	Less important
 Importance of Digital skills for the exercise of the job <i>Examples: Using office software and communication tools, analysing digital data, using programming languages</i>	Relatively important	Less important	Relatively important
 Importance of Management skills for the exercise of the job <i>Examples: Developing objectives & strategies, making decisions, organising, planning, coordinating, leading and motivating people</i>	Less important	Relatively important	Less important

Experimental design

Instructions

Your task:

In each scenario, please imagine that you have **received each of these 3 job offers** and now have to decide which one to accept. In each scenario we will ask you for the **percentage probability** of you **choosing each of the 3 alternatives**. The probability of each alternative should be a **number between 0 and 100**, and the probabilities of the three alternatives should **add up to 100**.

IMPORTANT: Please assume that the jobs available for choice are **otherwise identical in all other aspects**.

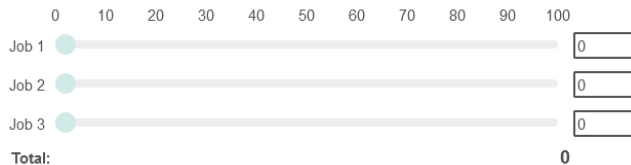
▶ Full instructions block A

▶ Full instructions block B

Experimental design

Choice task

For each of the 3 jobs, please indicate the probability with which you choose the job:
(each a number between 0 and 100, sum over the 3 jobs must be 100)



▶ Model

▶ Estimation

Online survey:

- biannual survey of Master's and PhD students at University of Basel 2021-2024
- stock in fall 2021 and new entrants spring 2022 to spring 2023
- follow-up each semester (incl. labour market entry) until fall 2024
- information on preferences, parental background, big 5, labour market expectations and aspirations, labour market entry, course choice criteria, skill self-assessments, expected returns to skills

Administrative data:

- basic demographics
- all courses with ECTS and grade

Text data on courses:

- course content, format and language
- type of examination

Results: Median WTP

Table 3: Estimated willingness-to-pay

	CHF			Percentage of average earnings			Diff. <i>p-val.</i>
	All CHF (1)	Men CHF (2)	Women CHF (3)	All % (4)	Men % (5)	Women % (6)	
Part-time	-11538.66*** (1449.64)	-9064.78*** (1211.21)	-14899.6*** (1914.44)	-10.13*** (1.27)	-7.96*** (1.06)	-13.08*** (1.06)	.010
Working hours	3188.88*** (227.45)	3378.47*** (296.81)	3032.77*** (306.65)	2.8*** (.2)	2.97*** (.26)	2.66*** (.26)	.418
Job growth	-4311.98*** (870.56)	-5965.23*** (1017.51)	-2533.12** (1223.45)	-3.78*** (.76)	-5.24*** (.89)	-2.22** (.89)	.032
Social skills	-6044.52*** (1932.38)	-1769.66 (2502.44)	-8740.19** (2789.15)	-5.31*** (1.7)	-1.55 (2.2)	-7.67*** (2.2)	.063
Digital skills	4706.24** (1906.74)	-2494.03 (2337.27)	8534.97*** (2381.28)	4.13** (1.67)	-2.19 (2.05)	7.49*** (2.05)	.001
Management skills	-1921.28*** (705.51)	-1236.78 (916.34)	-2011.28 (1315.09)	-1.69*** (.62)	-1.09 (.8)	-1.77** (.8)	.629
<i>Observations</i>	<i>469</i>	<i>175</i>	<i>294</i>	<i>469</i>	<i>175</i>	<i>294</i>	

Note: Median willingness to pay for job attributes for the whole sample and by gender. Bootstrapped standard errors (1000 replications) in parentheses. ***/**/* indicates significance on the 1/5/10% level based on bootstrapped standard errors. P-val. indicates significance of gender differences in median WTP.

Results: Heterogeneity in WTP

Table 5: Correlation of WTP estimates and basic characteristics

	Estimated WTP (as percentage of average earnings)					
	Part-time (1)	Hours worked (2)	Job growth (3)	Social skills (4)	Digital skills (5)	Management skills (6)
Female	-5.11** (2.71)	-0.17 (0.48)	3.06 (2.02)	-1.33 (4.66)	7.68* (4.42)	-0.62 (2.23)
Age	-0.45 (0.29)	0.01 (0.03)	-0.04 (0.20)	0.46 (0.61)	-0.08 (0.42)	-0.08 (0.28)
PhD student	-2.96 (2.66)	0.27 (0.41)	-3.60* (1.95)	-6.10 (5.59)	-11.29*** (4.37)	-1.09 (2.32)
Faculty (Reference = Medicine):						
Humanities and Social Sciences	-3.33 (3.69)	0.41 (0.53)	2.16 (3.06)	-2.10 (7.24)	-3.07 (5.38)	-3.10 (2.61)
Science	-0.08 (3.29)	1.34** (0.57)	5.13** (2.31)	11.71** (5.88)	-9.06* (4.76)	1.43 (2.55)
Business and Economics	2.79 (4.10)	0.04 (0.64)	1.82 (2.73)	1.87 (7.25)	-8.10 (6.97)	-3.56 (2.90)
Other Faculty	0.10 (3.55)	0.18 (0.51)	0.84 (3.00)	8.34 (9.84)	3.94 (6.17)	-4.76 (3.41)
<i>Observations</i>	<i>437</i>	<i>445</i>	<i>442</i>	<i>445</i>	<i>447</i>	<i>444</i>

Notes: Median regression. Dependent variable: Estimated willingness to pay for a unit change of the respective job attribute. Additional controls: Not Swiss, University entrance grade, risk tolerance, patience. Number of observations vary since we exclude students with infinite β s. We also trim the 1st and 99th percentiles of the respective WTP distribution. Bootstrapped standard errors (1000 replications) in parentheses. ***/**/* indicates significance on the 1/5/10% level.

Results: Role of Skill Perceptions

Table 6: Correlation of WTP estimates and self-assessed skills

	Estimated WTP (as % of average earnings)		
	Social skills (1)	Digital skills (2)	Management skills (3)
Female	-2.59 (4.97)	1.19 (3.94)	0.77 (2.42)
Age	0.75 (0.58)	0.03 (0.41)	-0.09 (0.24)
PhD student	-6.21 (5.96)	-9.13** (4.18)	-0.14 (2.74)
Self-assessed social skills	-12.19*** (3.06)	3.05 (2.72)	-1.19 (1.36)
Self-assessed digital skills	4.84 (4.28)	-11.69*** (2.77)	1.94 (1.80)
Self-assessed management skills	-0.56 (3.52)	2.14 (2.56)	-3.72** (1.64)

Note: Median regression. Additional controls: self-assessed skills, faculty and a dummy for missing information in any control variable. Bootstrapped standard errors (1000 replications) in parentheses. ***/**/* indicates significance on the 1/5/10% level.

Table 7: Job preferences: Correlation between experimental and survey measures

	Estimated WTP (as percentage of average earnings)					
	Part-time	Hours worked	Job growth	Social skills	Digital skills	Management skills
	(1)	(2)	(3)	(4)	(5)	(6)
Option to work part-time	-4.01***	-0.30	-0.05	-2.36	-1.97	0.86
	(1.54)	(0.23)	(1.06)	(2.34)	(2.00)	(1.14)
Low contractual hours per week	-1.46	0.20	-1.00	1.12	2.39	0.02
	(1.39)	(0.22)	(1.14)	(2.33)	(1.89)	(1.18)
Positive job growth	-1.63	-0.21	-3.36***	-0.98	1.86	1.17
	(1.24)	(0.22)	(0.98)	(2.10)	(2.09)	(1.36)
Use of own social skills	-0.48	-0.25	0.27	-6.29**	5.02**	-0.66
	(1.48)	(0.24)	(1.07)	(2.56)	(2.18)	(1.28)
Use of own digital skill	1.06	0.06	-0.40	2.67	-6.04***	2.06*
	(1.25)	(0.18)	(0.94)	(2.34)	(1.80)	(1.10)
Use of own management skills	-0.93	0.21	-0.97	-1.51	1.91	-4.30**
	(1.65)	(0.28)	(1.22)	(2.99)	(2.03)	(1.73)
High salary	3.82**	-0.15	2.05	0.19	1.23	-0.06
	(1.56)	(0.27)	(1.36)	(2.51)	(2.26)	(1.75)
<i>Observations</i>	<i>437</i>	<i>445</i>	<i>442</i>	<i>445</i>	<i>447</i>	<i>444</i>

Note: Median regression. Dependent variable: Estimated willingness to pay for unit change in respective job attribute. Independent variables: Stated importance of job criteria in the survey (1=not important to 5=very important). Additional controls: faculty and a dummy for missing information in any control variable. The number of observations varies as we exclude students with infinite β s. We also trim the 1st and 99th percentiles of the respective WTP distribution. Between 22 and 32 observations are dropped. Bootstrapped standard errors (1000 replications) in parentheses. ***/**/* indicates significance on the 1/5/10% level based on bootstrapped standard errors.

Conclusion

Main take-aways:

- part-time work, fewer hours and job growth valued positively
- use of social skills positively valued by women
- use of management skills has small positive value
- use of digital skills has large disutility for women
- own perceived skills drive skill-related job preferences

Policy implications:

- under-estimation of own digital skills: correct misperceptions
- lower actual digital skills: encourage skill investments

Outlook

Work in progress

Relate WTP to actual skills:

- To what extent do perceived and actual skills explain job preferences?

Relate WTP to labour market aspirations and outcomes:

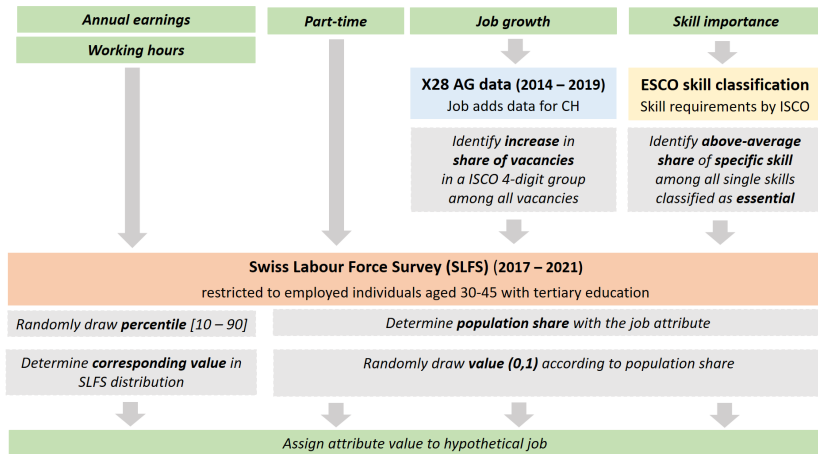
- Do job preferences explain job aspirations?
- Do job preferences explain occupational choices?
- Do job preferences explain inequality in earnings?

Appendix

Experimental design

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Choice of job attribute values



Instructions Block A

INSTRUCTIONS

Part A

In the following we will present you with 8 different scenarios. Each of the scenarios contains **3 different hypothetical job offers**. Each of the job offers is characterised by the following job characteristics:

1. **Gross annual salary** 5 years after starting the job (in CHF, when working full-time).
2. **Possibility to work part-time** (i.e. a work-time percentage below 90% is an option)
3. **Hours worked per week** (on average, in full-time)
4. **Positive job growth** (i.e. there has been an increase in vacancies in the job over the last few years)

Your task:

In each scenario, please imagine that you have **received each of these 3 job offers** and now have to decide which one to accept. In each scenario we will ask you for the **percentage probability** of you **choosing each of the 3 alternatives**. The probability of each alternative should be a **number between 0 and 100**, and the probabilities of the three alternatives should **add up to 100**.

IMPORTANT: Please assume that the jobs available for choice are **otherwise identical in all other aspects**.

Instructions Block B

Part B

In the following we will present 8 **more scenarios**, each with 3 hypothetical job offers. Each of the job offers is characterised this time by the following job characteristics:

- 1. Gross annual salary** 5 years after starting the job (in CHF, when working full-time).
- 2. Importance of social skills** for the exercise of the job
Examples: Communicating, working with others, networking, advising, negotiating, presenting
- 3. Importance of digital skills** for the exercise of the job
Examples: Using office software and communication tools, analysing digital data, using programming languages
- 4. Importance of management skills** for the exercise of the job
Examples: Developing goals and strategies, making decisions, organising, planning and coordinating, guiding and motivating people

Again, in each scenario, please assume that you have **received each of these 3 job offers** and now have to decide which one to accept. We will again ask you for the **percentage probability** of you choosing **each of the 3 alternatives**.

IMPORTANT: Please assume that the jobs available for choice are **otherwise identical in all other aspects**.

- Utility of subject i for job alternative $j = 1, \dots, J$: $u_{ij} = \beta_i X_j + \varepsilon_{ij}$
 X_j : vector of $k = 1, \dots, K$ job attributes of job j
 β_i : preferences over the K different job attributes
- With ε_{ij} extreme value distributed, the choice probabilities satisfy:

$$\ln\left(\frac{p_{ij}}{p_{ij'}}\right) = (X_j - X_{j'})\beta_i \quad (1)$$

- Willingness to pay derived from indifference condition:

$$u_{ij}(Y_j, X_k) = u_{ij}(Y_j + WTP, X_k + \Delta_j) \quad (2)$$

$$\beta_{iy} \ln Y_j + \beta_{ik} X_k = \beta_{iy} \ln(Y_j + WTP_{ik}(\Delta_j)) + \beta_{ik}(X_k + \Delta_j) \quad (3)$$

$$WTP_{ik}(\Delta) = \left[\exp\left(\frac{-\beta_{ik}}{\beta_{iy}} \Delta_j\right) - 1 \right] \times Y_j. \quad (4)$$

Y_j : annual earnings of job j

X_k : non-monetary job attribute k of job j

- 1 Stated choice experiment to elicit choice probabilities for all job attributes with possible error

$$\tilde{p}_{ij} = p_{ij} + \eta_{ij}, \quad j = 1, \dots, J \quad \eta_{ij} \sim i.i.d.(0, \sigma_\eta). \quad (5)$$

- 2 Estimate preference parameters β_i for each individual i using median regression (LAD estimator) to limit the impact of outliers:

$$M \left[\ln \left(\frac{\tilde{p}_{ij}}{\tilde{p}_{ij'}} \right) | X_j, X_{j'} \right] = (X_j - X_{j'}) \beta_i. \quad (6)$$

- 3 Calculate individual WTP for each job attribute and use bootstrap to obtain SE:

$$\widehat{WTP}_{ik}(\Delta) = \left[\exp \left(\frac{-\hat{\beta}_{ik}}{\hat{\beta}_{iy}} \Delta_j \right) - 1 \right] \times Y_j. \quad (7)$$

- 4 Regress individual WTP on characteristics to study preference heterogeneity and use bootstrap to obtain standard errors.

Table 2: Sample characteristics

	Study participants				University of Basel
	All	Male	Female	Diff (2)-(3)	All
	(1)	(2)	(3)	(4)	(5)
<i>Demographic characteristics:</i>					
Female	0.63				0.58
Age	28.08	28.95	27.54	1.41***	na
Nationality: Not Swiss	0.33	0.38	0.3	0.09*	0.36
<i>Personality characteristics:</i>					
Risk Tolerance (0 risk-averse, 10 risk-seeking)	6.27	6.56	6.09	0.48**	na
Patience (0 impatient, 10 patient)	7.31	7.83	6.99	0.83***	na
<i>Studies-related characteristics:</i>					
High School Grade: Very Good/Excellent	0.45	0.4	0.48	-.08*	na
Level of studies: PhD (vs. Master)	0.37	0.46	0.32	0.14***	0.42
Faculty of studies:					
Medicine	0.21	0.19	0.22	-.02	0.31
Science	0.31	0.37	0.27	0.1**	0.24
Humanities and Social Sciences	0.17	0.11	0.2	-.1***	0.19
Law	0.07	0.07	0.07	0	0.06
Business and Economics	0.09	0.16	0.05	0.11***	0.06
Psychology	0.08	0.05	0.11	-.06**	0.08
Educational Sciences/Theology	0.04	0.03	0.04	-.01	0.03
Inter-Faculty Study Programmes	0.04	0.02	0.04	-.02	0.04
<i>Observations</i>	<i>469</i>	<i>175</i>	<i>294</i>		<i>704</i>

Note: The table presents the mean characteristics of the study participants (for the whole sample and by gender) and of all Master's and PhD students enrolled at the University of Basel in fall semester 2022. ***/**/* indicates significant gender differences in characteristics on the 1/5/10% level based on two-sided t-tests.

Results: Distribution of Individual WTPs

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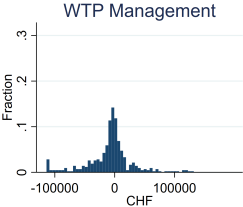
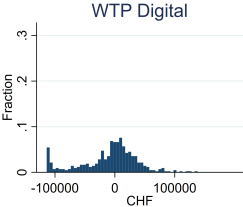
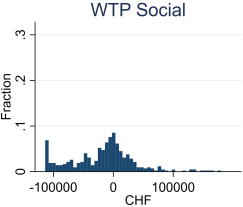
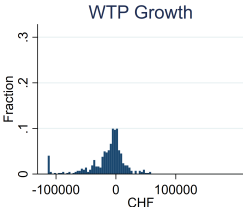
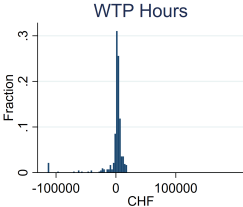
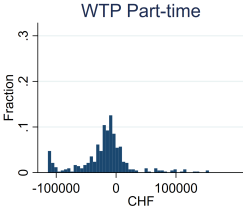


Table 4: Expected gender wage gap in the experiment

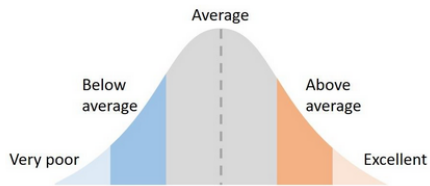
	Men CHF	Women CHF	Diff.		
			CHF (1)-(2) (3)	% (3)/(1) (4)	<i>p-val</i> (1)-(2) (5)
<i>I. All jobs</i>					
All scenarios	115545	114701	845*	0.73	0.07
Scenarios Block A	108718	107968	750	0.69	0.21
Scenarios Block B	122373	121433	939	0.77	0.13
<i>II. Jobs with highest choice probability</i>					
All scenarios	116115	115135	980**	0.84	0.04
Scenarios Block A	108512	107546	966	0.89	0.13
Scenarios Block B	123763	122870	894	0.72	0.17

Note: Expected annual earnings according to the job choices in the hypothetical choice game. Expected earnings are calculated by weighting the job-specific earnings with the stated choice probabilities, based on all jobs (Panel I) or only jobs with the highest probability within a scenario (Panel II). ***/**/* indicates significance on the 1/5/10% level based on two-sided t-tests.

0.9% of average annual earnings and 6.6% of of the raw gender pay gap of 13.6% university graduates in CH in 2020 (Kaiser and Möhr, 2023)

Self-assessment of your interdisciplinary skills

All doctoral students have skills, but inherently, they are differently developed for each individual. The following normal distribution aims to illustrate this:



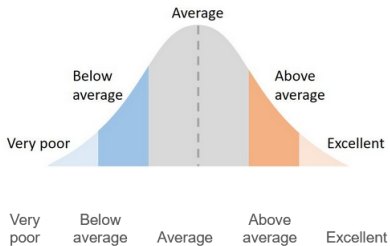
The graph shows in a simplified way that skill levels within a population of doctoral students are typically normally distributed, i.e.:

- the largest proportion of students have average skills (*grey range*)
- a smaller proportion have below- or above-average skills (*blue or orange range*)
- a very small proportion have very low or excellent skills (*light blue or light orange range*).

In the following, please assess your personal skills using the ranges of this normal distribution as a reference.

Example Skill Self-Assessment [▶▶ Back](#)

Overall, how would you rate your personal skills in the following domains?



Social skills

Examples:

- Communicating with others
- Working with others
- Networking
- Presenting information
- Negotiating
- Advising



Table 6c: Heterogeneity in skill self-assessment

	(1)	(2)	(3)
	Social skills	Digital skills	Management skills
Female	0.02 (0.08)	-0.34*** (0.07)	0.07 (0.08)
Age	0.01 (0.01)	-0.00 (0.01)	-0.00 (0.01)
Nationality: Not Swiss	0.02 (0.09)	-0.03 (0.08)	0.19** (0.09)
Level of studies: PhD (vs. Master)	-0.01 (0.10)	0.08 (0.08)	-0.06 (0.10)
University entrance grade > median	0.01 (0.08)	0.15** (0.07)	0.05 (0.08)
Risk tolerance > median	0.23*** (0.08)	0.04 (0.07)	0.20** (0.08)
Patience > median	0.12 (0.08)	-0.01 (0.07)	-0.03 (0.08)
<i>Observations</i>	<i>438</i>	<i>438</i>	<i>438</i>

Note: Median regression. Additional controls: actual skills, average grade, faculty and a dummy for missing information in any control variable. Bootstrapped standard errors (1000 replications) in parentheses. ***/**/* indicates significance on the 1/5/10% level.

Table A1: Importance of job aspects (survey responses)

	All subjects	By gender		
	Means	Male	Female	Diff.
Job aspects:	All	Male	Female	(2)-(3)
	(1)	(2)	(3)	(4)
<i>Salary and job stability:</i>				
High salary	3.48	3.58	3.41	0.17**
Permanent position	3.97	4.03	3.94	0.09
Good career prospects	3.81	3.86	3.79	0.07
Positive job growth	3.53	3.51	3.54	-0.03
Secure job	4.12	4.09	4.14	-0.05
<i>Work-life balance:</i>				
Option to work part-time	3.49	3.29	3.62	-0.32***
Low contractual hours per week	2.86	2.79	2.89	-0.11
Flexible hours/homeoffice	3.66	3.69	3.65	0.04
Reconcile work family	4.07	3.99	4.11	-0.12
Meaningful job	4.52	4.45	4.56	-0.11
<i>Skill-related aspects:</i>				
Match with own academic level	4.06	4.01	4.09	-0.08
Use of own personal qualifications	4.22	4.2	4.23	-0.03
Use of own social skills	3.78	3.61	3.88	-0.27***
Use of own digital skill	3.03	3.24	2.9	0.34***
Use of own management skills	3.36	3.31	3.4	-0.09
<i>Observations</i>	<i>469</i>	<i>175</i>	<i>294</i>	

Note: Table shows the students' answers to the survey question: "How important are the following aspects of jobs to you?", with the following answer options: 1="Not at all important" 2="Rather less important" 3="Moderately important" 4="Rather important" 5="Very important". ***/**/* indicates significance on the 1/5/10% level based on two-sided t-tests.