

A tale of two paths: Gender-based academic trajectories – an event history analysis

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Research questions

- Is there gender bias in academic careers?
 - Leaky pipeline: Do women have higher probability to leave the academic career than men?
 - Glass ceiling: Do women have more difficulties (= lower probability) to become full professor?
- Do grants play a role?
 - Affecting the academic career towards full professorship?
 - Bias in grant decisions contribute to bias in careers?

The literature

- Increasingly including performance data
 - In different ways – not always satisfactory
- Direct versus indirect (=mediated) effects of gender
- Standard for analysis: event history analysis
- Emerging experimental approaches
- Complexity: many covariates

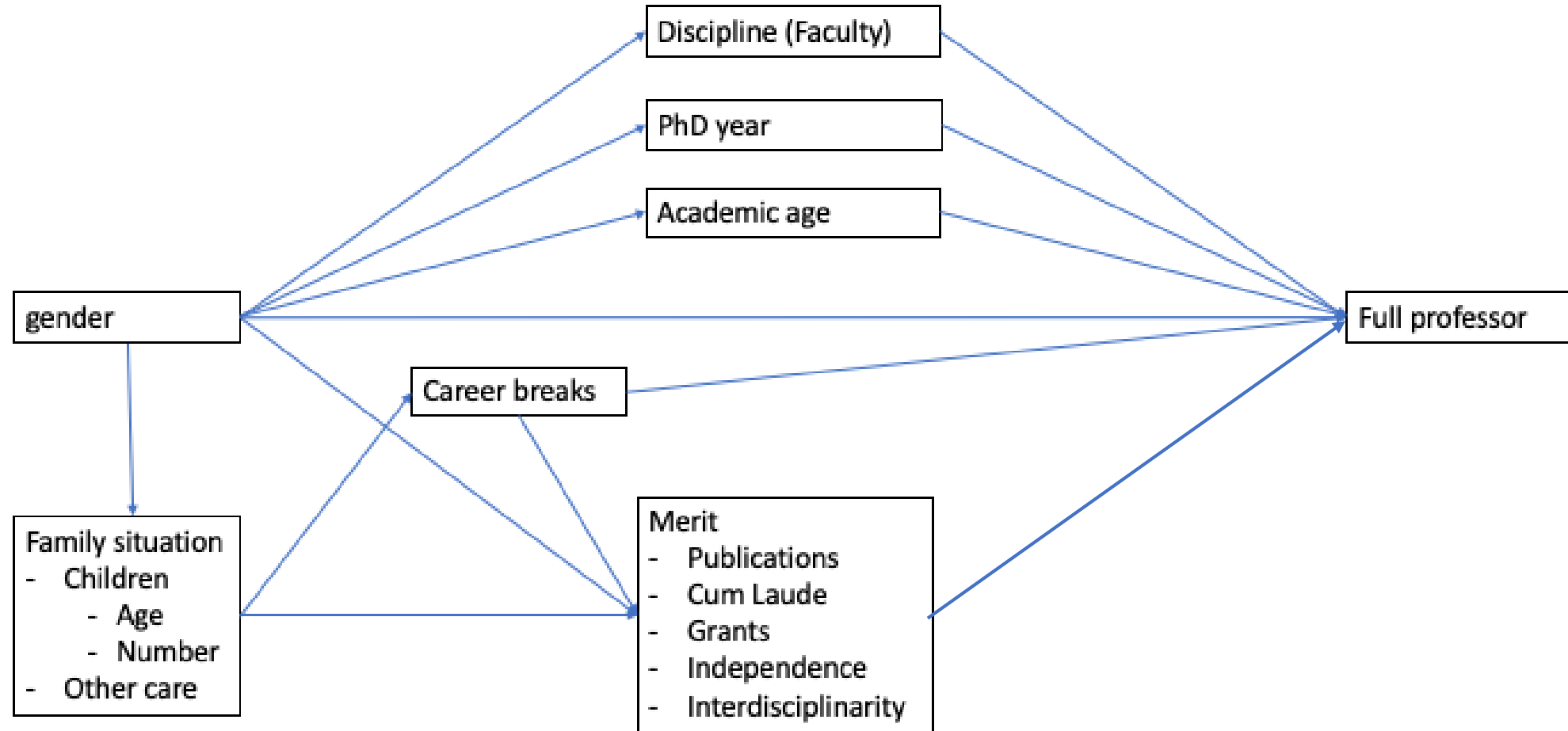
Early versus late appointment as professor

- Different career types
 - Early appointment → research performance
 - Later appointment → based on other achievements (teaching, management)
- Duration
 - If one follows the complete career, one sees how it worked in the past
 - If one wants to study how it works today, the careers are only halfway
- Mechanisms may differ between periods and career types
 - Our model is therefore specific

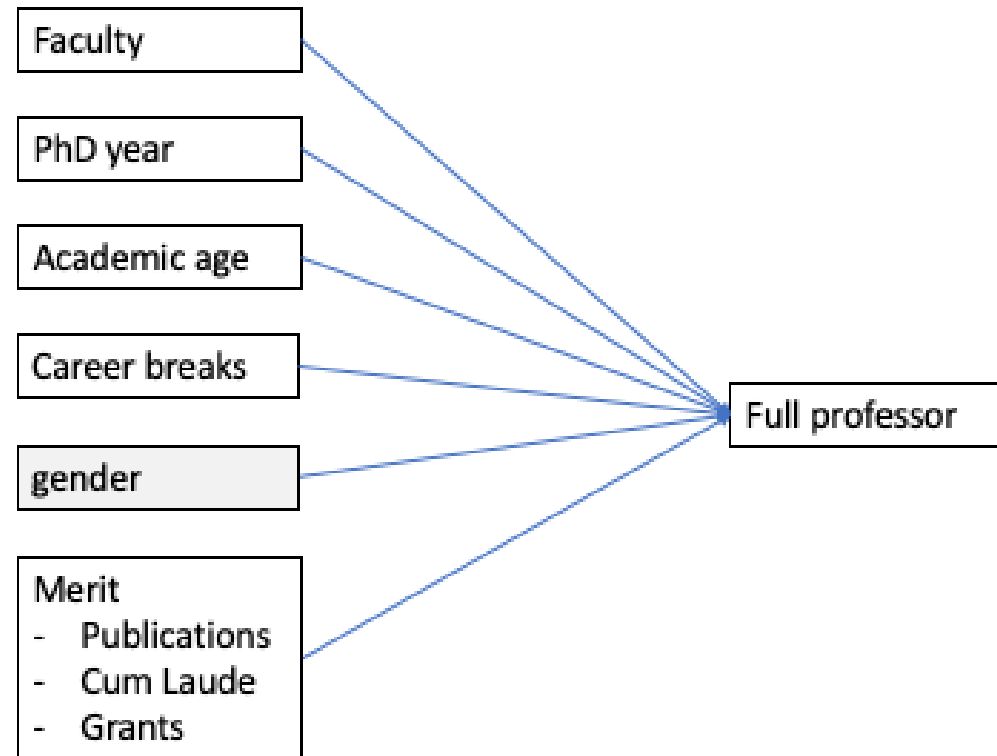
Relevant covariates

- Merit variables
- Individual preferences and choice (versus discrimination/bias)
- Disciplinary differences
 - Academic age
 - Career breaks
- Organizational differences (universities vs research institutes)
- National differences

Direct and indirect gender effects



Causal Model



Design and the case

- Careers of recent cohorts (PhD between 2000 and 2005)
- Able to follow 16 - 21 years after PhD
 - NL: average moment to become full professor is 18 years after PhD
 - In our sample: average 12.5 years after PhD
- Sample: all who received the PhD at one specific university
 - no selectivity in participation
- Bibliometric variables:
 - (i) medicine; (ii) dentistry; (iii) life & earth sciences; (iv) natural sciences, math and computer science; (v) psychology & movement science; (vi) economics

Data and data sources

- Independent, measured once:
 - Gender (University PhD database; Dissertations)
 - Cum Laude (University PhD database)
 - Year of attaining PhD (University PhD database; Dissertations)
- Independent, cumulative measured per year:
 - Accumulated performance (FracP; P10%: DZHW Scopus)
 - Prestigious individual *career grants* (NWO: website & Narcis database; ERC: website)
 - Breaks, periods of at least 3 years without publication (DZHW: Scopus)
 - Academic age
- Dependent:
 - Career: appointed to full professor (in NL: Narcis database; foreign: web search)
 - Career: leave academia (DZHW: Scopus)

Method: Event history (survival) analysis

- Annual data -> discrete (versus continuous) time model
- Event history analysis using the logit function
 - Every person/year as case (= 'longform' data)
 - 'Censored' when one stops (3 years) publishing: exit from academic system
 - In the next year removed from the analysis - if no later publications
 - 'Censored' when appointed as full professor
 - In the next year removed from the analysis

Analysis

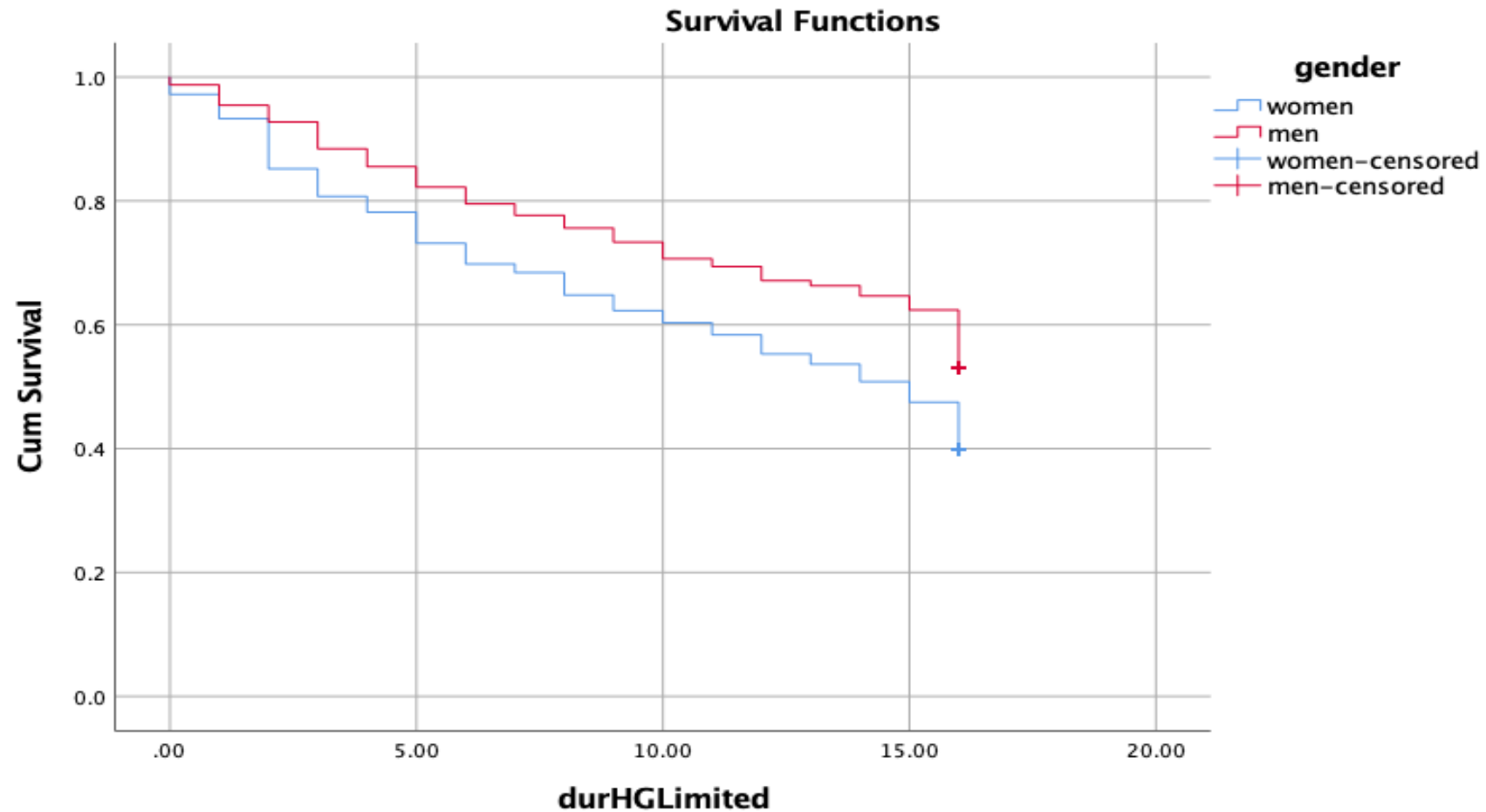
- **Step 1:** Descriptive statistics
- **Step 2:** Descriptive analysis of leaving academia & appointment to full professor
- Step 3: Event history analysis (EHA) for men and women separately
- Step 4: Where regression coefficients differ: test for interaction
- **Step 5:** A model including gender plus the significant interactions with gender
- Step 6: A series of controls
 - Split the cohort into two sub-cohorts
 - Keeping everyone in the analysis
 - Different career length in the analysis (16 to 21 year)
- Step 7: Rerun step 3 to 6, but now predicting leaving academia

Some descriptive statistics 2000-2005 cohort

Some descriptive results

- **Glass ceiling (by 2022)**: 9.2% of the woman and 14,7% of the men are appointed as full professor (ratio m/w = 1.6); and men do so at a substantial younger academic age
- **Leaky pipeline (after 16 years)**: 50% of women left (stopped publishing), versus 36.2% of the men (ratio m/w = 0.72)
- **Bias in awards**: 1,8% of women got cum laude, and 3,9% of men
- **No bias in grants (after 16 years)**: 5,76% of women got an NWO career grant, and 5.73% of the men – interestingly equal

Kaplan-Meier: Remaining in academia



Appointment to full professor

academic age	women	men	total
3	0	3	3
4	0	2	2
5	0	3	3
6	0	4	4
7	1	6	7
8	0	8	8
9	2	1	3
10	3	5	8
11	1	7	8
12	5	3	8
13	3	3	6
14	2	6	8
15	0	6	6
16	4	6	10
Total	21	63	84
percentage of cohort	5.30%	10.94%	8.64%

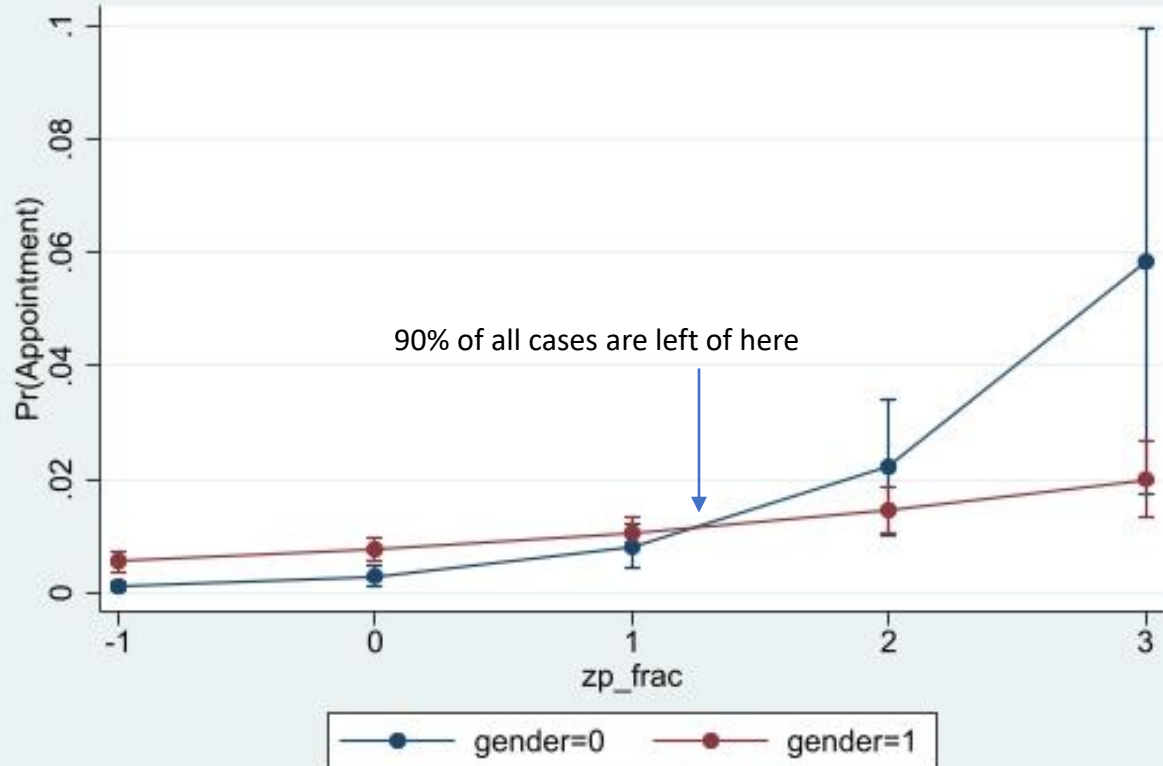
Findings: Appointment as full professor

	B	df	Sig.	Exp(B)	95% CI LB	95% CI UB
Earth and & life sciences (versus medical)	-.14	1	0.72	0.87	0.41	1.84
Math, comp, physical sciences	-.37	1	0.32	0.69	0.34	1.42
Psychology, movement sciences	.56	1	0.12	1.75	0.87	3.52
Economics	.79	1	0.02	2.21	1.14	4.30
PhD year	.02	1	0.76	1.02	0.89	1.18
Male (versus female)	1.06	1	0.01	2.89	1.36	6.16
Cum Laude (versus no cum laude)	-.34	1	0.42	0.71	0.31	1.63
Fractional papers*	.99	1	0.00	2.69	1.95	3.72
Total number of career grants*	.17	1	0.00	1.18	1.06	1.32
Academic age	.45	1	0.00	1.57	1.18	2.09
Academic age squared	-.02	1	0.01	0.98	0.97	0.99
Male x fractional papers*	-.69	1	0.00	0.50	0.36	0.70
Career breaks of three years	-.40	1	0.60	0.67	0.16	2.92
Male x Career breaks of three years	.10	1	0.90	1.11	0.23	5.33

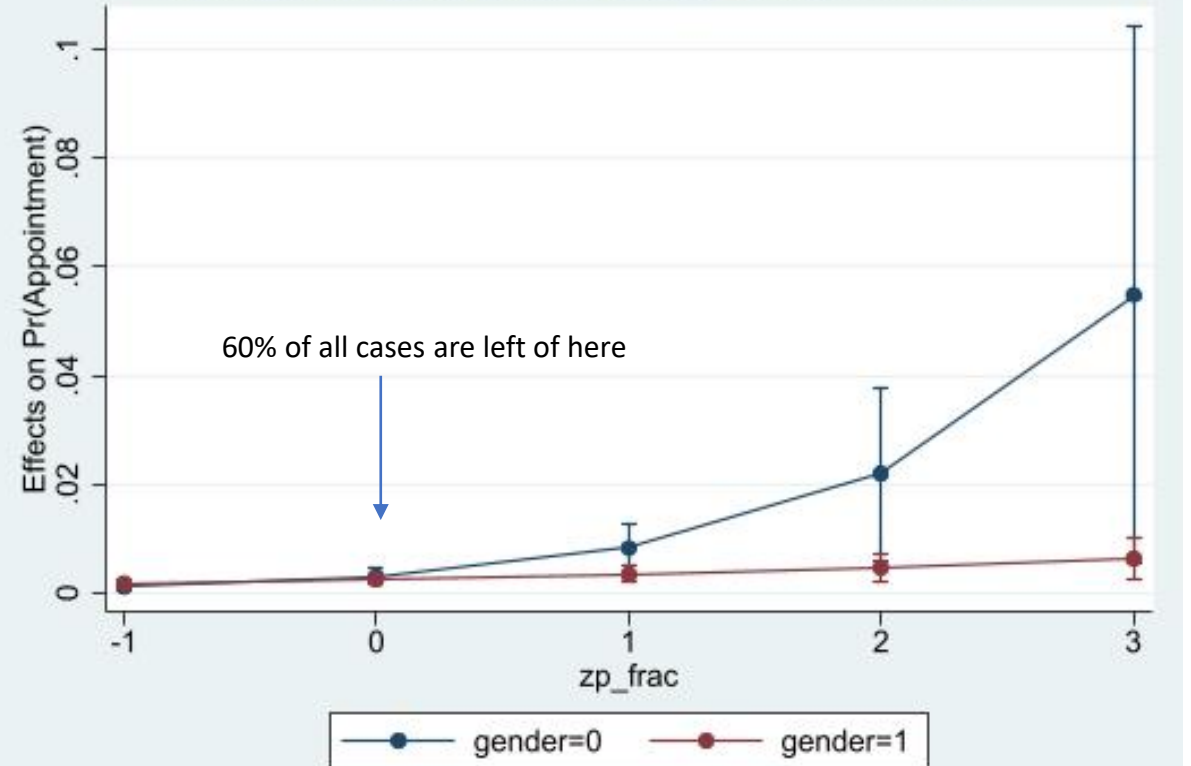
Logistic regression; Exp(B): odds ratio; *= z-score at faculty level; Nagelkerke pseudo $R^2 = 0.147$

Interaction effect

Predictive Margins of gender with 95% CIs



Average Marginal Effects of zp_frac with 95% CIs



gender=0: women; gender=1: men

Some conclusions

- Gender bias in careers exists
 - **Leaky pipeline**: Women leave more often, especially in the early years – not explained by performance
 - **Glass ceiling**: After controlling for a variety of (merit) variables, women are appointed as full professor
 - less often
 - later
- Performance has little effect for men, but it has for women
 - Does **meritocracy** exist only for women?

Further work

- Other techniques for event history analysis
- For a publication: extending the period covered with a few years
- Include associate professor as in between career step
- More performance indicators
 - academic independence; (cognitive) mobility; more grant types
- Survey or web search about private situation
 - for practical reasons: only those that remained in science

Thanks for your attention

Comments? Questions?