Gender disparities in career paths in math: findings from a mixed-method approach

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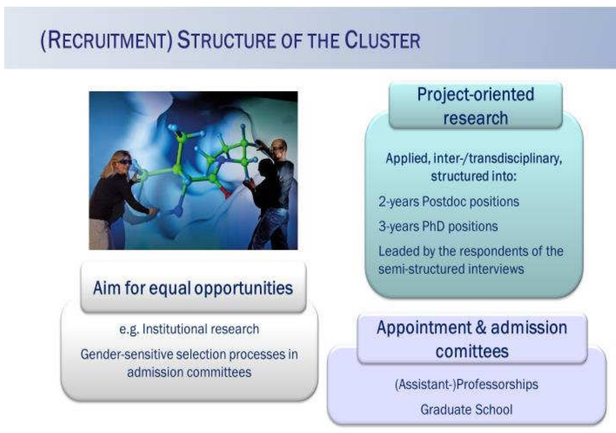
Introduction & Background

- Women still underrepresented among professorships in math (GWK 2021, Statistisches Bundesamt 2021)
- Two different explanations: ***leaky pipeline*** (Berryman 1983) and ***glass ceiling*** (Bryant 1984)
- Project goal: investigate possible causes and mechanisms that reproduce gender disparities in a mathematical cluster of excellence

Research Questions

Gendered patterns of gatekeeping & recruitment in different career stages



Two different approaches:

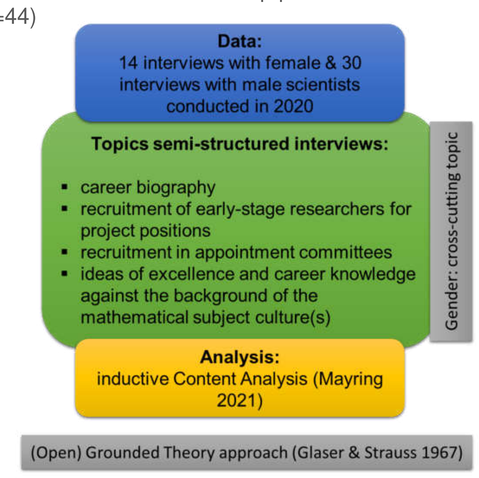
	Qualitative approach	Quantitative approach
Research questions	(1) What patterns of gendered gatekeeping in the recruitment of (early-stage) researchers for project positions can be found? (2) Are there variations for early- and later-stage researchers?	(1) Are there antifemale gender biases in the recruitment of (W1-) assistant professors? (2) Do we see preferential selection of equally qualified women?
State of research	• Gendered gatekeeping as a reason for women's underrepresentation in academia (also in excellent research environments) (e.g. Husu 2004; Wolffram 2018) • Gender stereotypes contribute to women being ignored in recruitment processes (Kahlert 2013) • Affirmative action policies and excellence are perceived as mutually exclusive by German professors (Klammer et al. 2020)	• Hardly any studies on gender disparities in hiring for assistant professorships & mixed findings: gender biases against women (Gerxhani, Kulic, Liechti 2021) vs. no gender biases against women (e.g. Williams, Ceci 2015; Carlsson, Finseraas, Midtbeen, Guobjörg, Rafnsdottir 2021, Henningsen, Horvath, Jonas 2021)
Research desiderata	No studies focusing on math and comparison between different job positions and career stages	Further validation needed

Data & Method

Qualitative approach

Semi-structured interviews

- Respondents: Scientists in leadership positions in research projects in the cluster (n=44)



Quantitative approach

Experimental data from factorial survey (vignette study)

- Respondents: German professors in Math/Physics (n=700), Social Sciences (n=908), German Studies (n=249)
- Rating of short fictitious profiles ("vignettes") of applicants for assistant (W1-) position in terms of (a) perceived competence and (b) likelihood of inviting the applicant to a job interview
- Between-subject design for applicant's gender

Dependent Variables	Scale		
- Qualified - Invite	1-7		
Vignette Dimensions	**Levels**		
- Gender applicant	Female	Male	
- Type of position - Publication type - Research collaborations - Third-party funding - Parental leave	Tenure-track Majority solo-authored (peer-reviewed) With renowned scholars No (note does not appear) No (note does not appear)	Non- tenure track Majority co-authored (peer-reviewed) With scholars of same level Successful aquisition 6 months parental leave	All co-authored (peer-reviewed)
Fixed Characteristics & Control Variables			
Fixed characteristics: completed German PhD with *magna cum laude* (very good), 4 years work experience as Postdoc, Teaching experience Control variables: gender respondent, academic age respondent, other controls necessary for vignette analyses (e.g. position vignette within deck)			

Method: Multi-level linear models with random intercepts and Average marginal Effects (AME)

Results

Qualitative study

(1) Tendencies for reinforcement of gender disparities in recruitment of early-stage researchers for project positions due to:

Internal recruitment as a common practice

- Problematic when the proportion of women is low → proportion remains low
- Possible reinforcement of this cycle: female early-stage researchers perceived as unwilling to pursue academic career

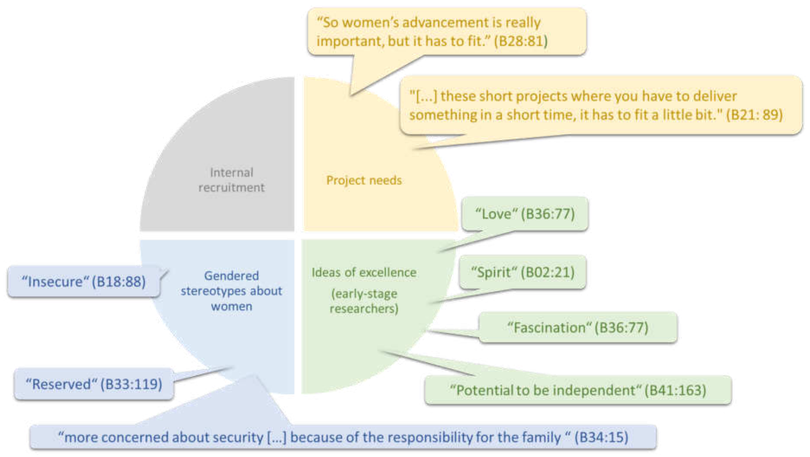
(Subjective) ideas of excellence and project needs

- Excellence, the specifics of project work, and the support of women are perceived as mutually exclusive by some respondents
- No consistent and objective definition of excellence in recruitment of early-stage researchers

Gendered stereotypes

- Gendered stereotypes still powerful also in excellent research environments

(A) Factors reinforcing gender disparities in recruitment of early-stage researchers for project positions



(2) Attribution of good chances for female later-stage researchers in appointment procedures

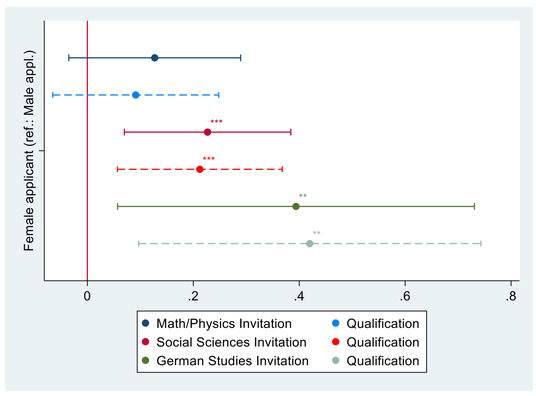
"But what I also observe is that the women who, for whatever reason, have fought their way through […] who then get to the point so to speak, that they are traded for professorships suddenly the market for these women is very very good." (B04:77)

- Female scientists perceived to have good, or even better, chances than men to be „traded for professorships"
- However, this is mainly justified on the grounds of affirmative action and not on performance

"[…] that I was invited so often, of course had to do with the fact that women should also be invited more often […] but I also knew that in advance." (B41: 55)

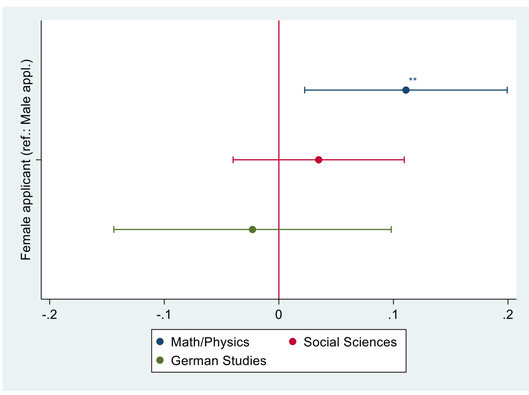
Quantitative study

(A) Applicant's gender differences in the likelihood of being invited (solid lines) and of being perceived as qualified (dashed lines) **

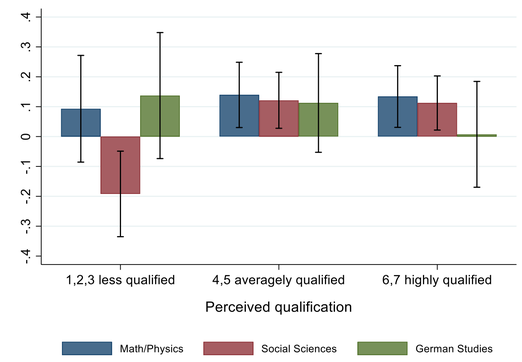


(1) No female disadvantage in being perceived as competent and being invited for a job interview for an assistant professorship position in Math/Physics

(B) Applicant's gender differences in likelihood of being invited when perceived as equally qualified **



(C) Applicant's gender differences in the likelihood of being invited by perceived qualification (AME) **



(2) Invitation is mainly based on perceived qualification – no to very small advantages for female applicants

- ✓ Female advantage in being invited goes beyond and above advantage in being perceived as competent but is very small and does not change the „game"
- ✓ Main message: no gender biases at this stage

Conclusion

1. Barriers especially for female early-stage researchers due to:
   - practice of internal recruitment
   - (subjective) ideas of excellence and project needs
   - gender stereotypes
2. Discrimination at the transition to assistant professorships does not seem to take place:
   - quantitative results show when equally qualified women apply for assistant professorship they have good chances being invited
   - qualitative results show good chances for women are also assumed and not only perceived as being performance-based but traced back to the use of affirmative action policies
3. Findings indicate:
   - internalization of affirmative action policies for appointment procedures for professorships
   - greater formalization (e.g. officially structured hiring processes with defined and transparent recruitment criteria) lead to fewer gender biases

Future research

- Focus on reasons for drop-outs of women at early stages of academic careers

* The quotes were translated into English by the researchers
** Models include all dimensions

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Picture: https://www.fu-berlin.de/en/sites/inu/excellence-strategy/proposals/math/index.html

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