

PARENTHOOD AND THE ACADEMIC LADDER

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"After graduation, as soon as women give birth and become mothers, they fall behind and don't end up in leadership positions."

Katalin Kariko, 2023 Nobel Prize Winner in Medicine

- Women are under-represented in academia
 - Professors, continental Europe: 30 %; US: 20 %
 - Denmark - the setting of this paper - 24 %
- The unequal responsibilities around children identified as the key point preventing gender equality in the labor market

Bertrand, 2020; Goldin, 2021

 - 'Child penalties' globally e.g. Harkness & Waldfogel, 2003; Kleven et al., 2019; Pan & Cortes, 2023; Kleven et al., 2024
 - Domain-specific child penalties Bertrand et al., 2009; King & Fiva, 2023; Bonney et al., 2025
 - Glass ceiling and children Bütikofer et al., 2018; Corekcioglu et al., 2021

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Research Questions

- What is the effect of children on career trajectories in academia?
- How does the child penalty in getting tenure vary by career stage?
- How is scientific productivity affected by children?
- What mitigates these penalties?

Representation Matters

- Quality loss if researchers are not selected from the entire distribution of talent
- Identity of researcher is important for shaping the direction of research
- Role models could improve perceptions of women in male-dominated fields and weaken stereotypes in society

Why Academia?

- Characteristics of the occupation
 - Career-driven and highly educated individuals
 - Well-defined career ladder, where the most demanding years for research productivity (i.e. tenure track) often coincide with fertility
 - Flexibility, but with non-linear returns to hours (research hours residual after teaching/service)
- Ex-ante unclear whether penalties should be larger or smaller (flexibility vs rigid promotion system and convex returns to hours)

Gender Gaps in Academia

- Gender gaps in tenure rates Kahn, 1993; Ginther & Kahn, 2021; Auriol et al., 2022
- Women's scientific productivity decline around marriage/parenthood Kim & Moser, 2025
- Women are more likely to face discrimination and harassment Sarson et al., 2021; Hengel, 2022; Folke & Rickne, 2022; Ross et al. 2022 and lack support and role models Dupas et al., 2021; Porter & Serra, 2020

→ Track individuals from the onset of their research career (PhD), overcoming survivorship bias
→ First order: Child penalties on staying in academia and tenure
→ Attrition in early stages is particularly relevant as entry requirements into the career are increasing

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Fertility, occupational choice, and child penalties

- Extensive margin in human capital-intensive occupations Fiva & King, 2023
- Occupational choice and fertility are perhaps choices made jointly Adda et al., 2017
- Pipelines and promotions are difficult to observe

→ We can identify child penalties on a promotion decision

→ Child penalties in a human capital intensive occupation with high internal motivation

→ Richness of the data allows us to investigate mechanisms influencing the size of the penalty

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Institutional Setting: Danish Academia

- Academic hierarchy is similar to other European countries
3-year PhD program → (PostDoc) → Assistant Prof. → Associate Prof. → Full Prof.
- Earnings for faculty and PhD students are set in collective bargaining
- Teaching is done by faculty
 - Assistant Professors teach 33 % - 50 % of their time
 - Teaching faculty is very rare
- Faculty and PhD students have the right to paid parental leave
 - Leave for up to 11 months is compensated at UI levels (EUR 2.700) or higher
 - Temporary contracts and tenure track extended by the amount of leave taken

Data: Administrative, Archival, and Scopus

- From **administrative data** (1996-2021), we obtain
 - Education (field of MA, PhD enrollment)
 - Sectorial employment (University, Broader Research, ...)
 - Labor market earnings and parental leave duration
 - Family outcomes: timing of children and partner characteristics
- Information on centralized bargaining from the archive of the academic union
 - Used to define the **academic position** of the researcher
 - Using the centralized 'earnings floor' for each position (PhD student, Assistant Professor, Associate Prof., Full Professor) and earnings, we infer the position [» Details](#)
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Defining our Sample

- Individuals who enroll in a PhD (1996-2017)
 - N=36K of which 46 % are women
 - Excl. those who have a child before enrollment (30%)
 - Excl. those not (yet) observed with a child (34%)
 - **Estimating sample: 12.359 of which 45 % are women**
- Main Outcomes
 - Academic Employment
 - Main employment - defined from pension contributions - is at a university
 - Extension: employment in 'broader research' (e.g., research institutes)
 - Tenure
 - Working at a university AND earnings above the earnings floor of an associate professor
 - Adjustment for part-time contracts
 - Leave is not fully compensated, but there is job protection

Adams et al., 2024; ILO definition

→ The year of parental leave, a person cannot move from tenured to non-tenured

Descriptive Statistics

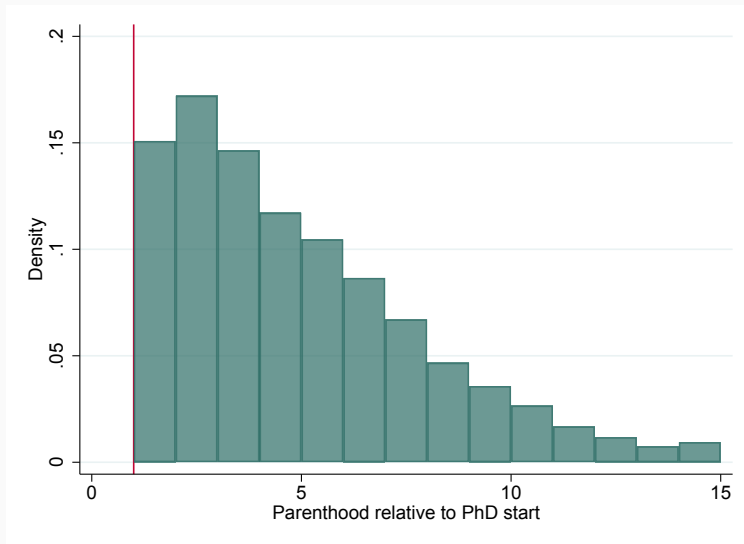
	Men	Women
<i>Share of Fields</i>		
STEM	60.14%	48.97 %
Wet	18.71%	33.08 %
Dry	41.43 %	15.89 %
Medicine	10.24 %	18.9%
Social Science	9.87 %	10.2 %
Humanities	6.88 %	8.8 %
University employed post PhD	42.95 %	39.12%
Ever Had Tenure	29.93 %	22.95 %
Ever Published	55.78 %	53.62 %
Age at Start of PhD	27.14	27.57

Fertility Outcomes (10 Years After PhD Start)

	Men	Women
<i>Academics</i>		
Has at least one child	78.65 %	90.27 %
Fertility rate	1.44	1.63
Age at first child	30.64	29.69
<i>Left Academia</i>		
Has at least one child	81.25 %	85.47 %
Fertility rate	1.51	1.45
Age at first child	30.11	29.36

Antecol et al (2018) find that 74 % of men and 72 % of women become parents within the same time frame (US, top 50).

Parenthood Patterns Relative to PhD Start



» Split by Sex

- Follows the event study specification in Kleven, Landais & Sørensen (2019)
- Event time τ is indexed relative to the year of parenthood
- Event study specification separate for men and women:

$$Y_{i,t}^g = \sum_j \alpha_j^g \cdot \text{EVENT}_{j=\tau} + \text{age/year/PhDyear dummies} + u_{i,t}$$

where $\hat{\alpha}_\tau^g$ is the impact of parenthood on gender g at event time τ . ► Event studies

- Define counterfactual outcome, $E[\tilde{Y}_{i\tau}^g | \tau]$, net of the contribution of children

► Counterfactual trends :

$$Y_{i,t}^g = \text{age/year/PhDyear dummies} + v_{i,t}$$

- To get the relative impact of children for women and men, we divide the impact ($\hat{\alpha}_\tau^g$) by the counterfactual outcomes ($E[\tilde{Y}_{i\tau}^g|\tau]$):

$$P_\tau^g \equiv \frac{\hat{\alpha}_\tau^g}{E[\tilde{Y}_{i\tau}^g|\tau]}$$

- The **Child Penalty** is defined as:

$$\mathbb{E}[P_\tau^m - P_\tau^w \mid \tau \geq 0]$$

Are Child Penalties Causal?

Identifying Assumptions

- Short-run penalty relies on smoothness around $t = 0$
- No self selection into parenthood depending on career stage
- Long-run penalty relies on parallel trends between men and women, conditional on controls for time and lifecycle trends

Validation

- Use people who never had children as controls
- Recent criticism: estimates sensitive to age at parenthood and educational attainment

Adams et al., 2024; Melentyeva & Riedel, 2023 → our sample is highly homogeneous

Outline

Motivation

Setting

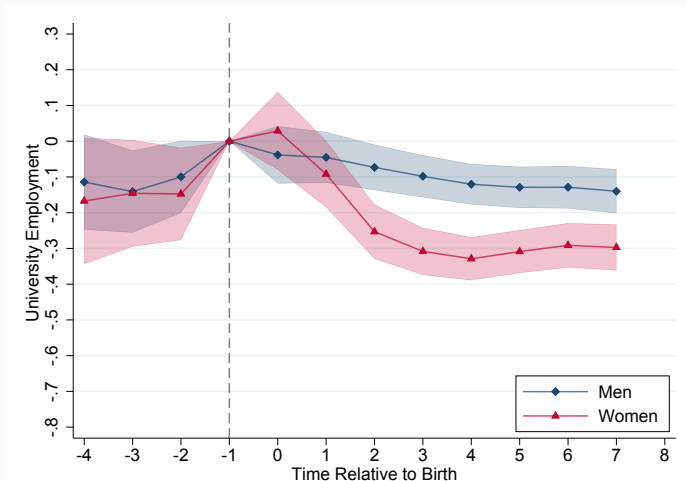
Data

Research Design

Results

What is the effect of children on career trajectories in academia?

Result I: Women Leave Academia After Parenthood

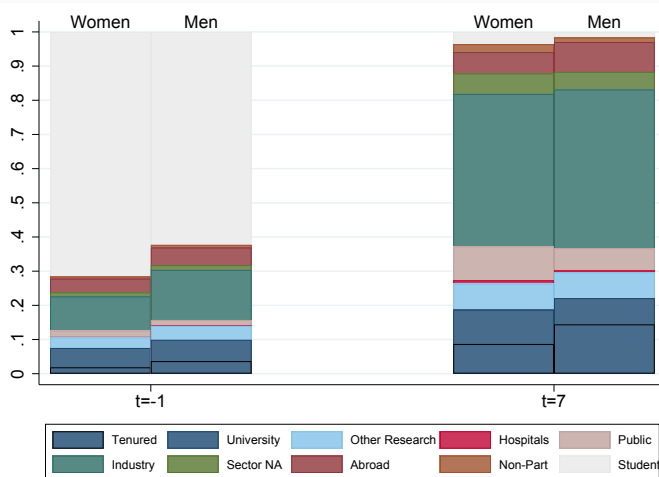


Main employment (largest pension contributions) is at a university, excl. phd student. Child is born in $t=0$.

In $t-1$, 7.9 % of women (10.5 % of men) are working at universities.

Parenthood Often Takes Place During the PhD

Employment sector relative to parenthood (t=0)

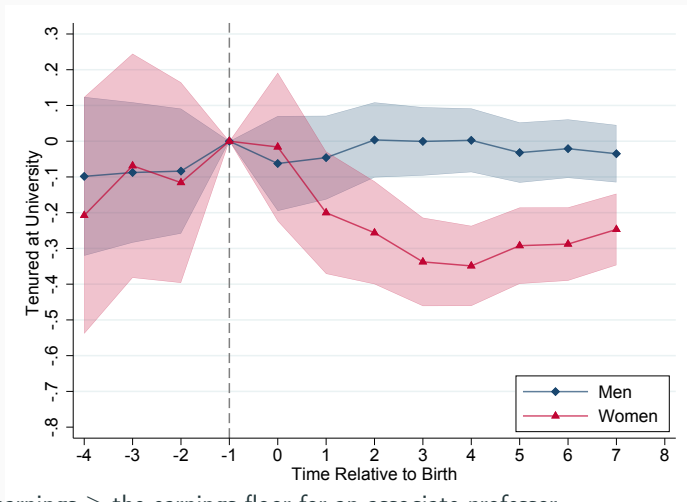


Is Attrition from Universities Driven By?

- Moving to the broader research sector? NO. [» Broader Research versus Universities](#)
- Going abroad? NO. [» Going Abroad](#)
- Leaving the labor force? NO. [» Non-participation](#)

How does the child penalty in getting tenure vary by career stage?

Result II: Women Don't Become Tenured After Parenthood

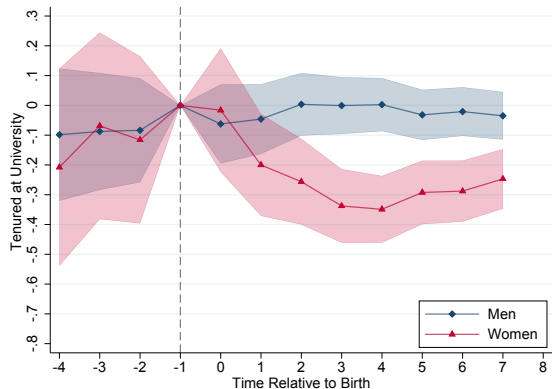


Tenure is defined as earnings \geq the earnings floor for an associate professor

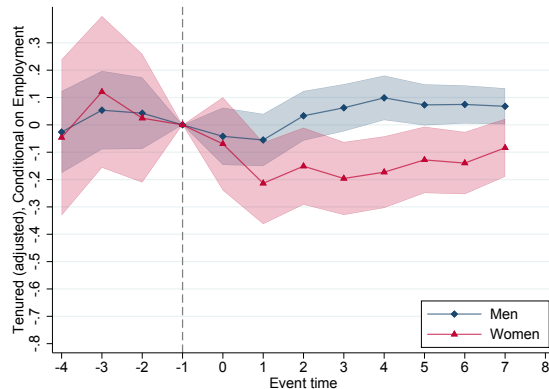
In t-1, 2.0 % of women (3.9 % of men) are tenured.

Tenure Conditional on Being Employed at a University

Unconditional Tenure Rates

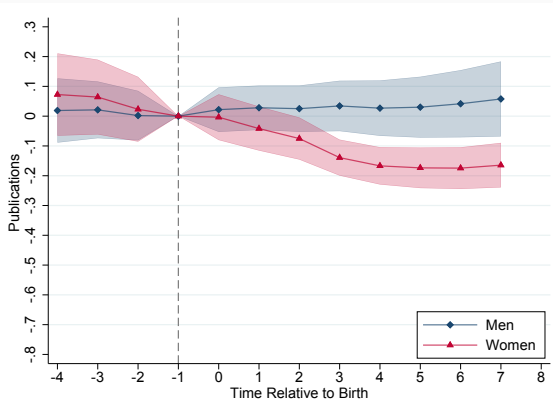


Conditional on University Employment

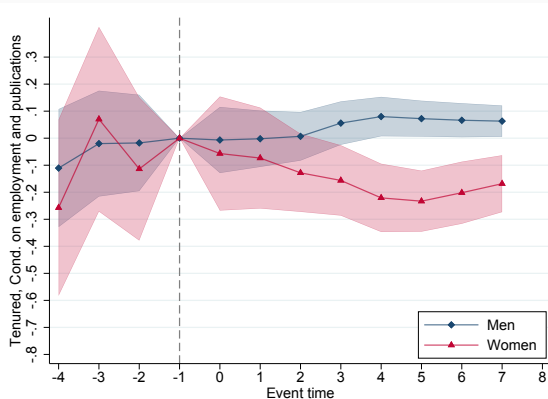


Tenure Conditional on Being Employed at a University and Publications

Cumulative Publications



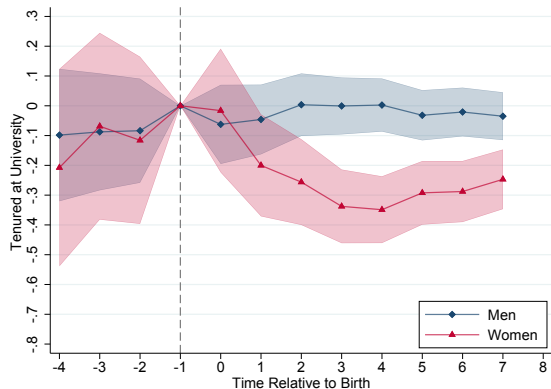
Conditional on University AND Publications



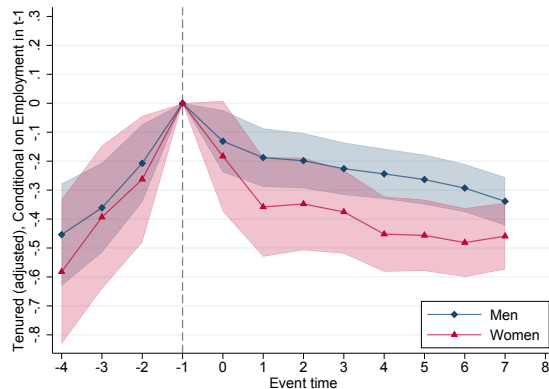
In t-1, women have 5.2 publications. Men have 8.5 publications.

Tenure Conditional on Having a Child After Getting an Academic Position?

Everyone



Conditional on University emp. in t-1



Tenure is defined as earnings \geq the earnings floor for an associate professor

In t-1, 2.0 % of women (3.9 % of men) are tenured. Conditioning on university employment in t-1, 24.9 % of women (and 37.1 % of men) are tenured. [► Event Studies: Publications](#)

- Field FE do very little for survival rates, tenure, and publications
- Hardly any differences between the younger and older cohorts
- Penalties in $t=7$
 - Labor market earnings: 12% ▶ Event Studies: Earnings
 - Industry employment ▶ Event Studies: Industry Employment
 - Public sector ▶ Event Studies: Public Sector Employment
 - Part-time university affiliation (not main job) ▶ Event Studies: Part-time Contract
 - Extending their studies ▶ Event Studies: Incl. students

What Mitigates Child Penalties? Families vs Institutions

Can a supportive spouse alleviate the child penalty?

- Differences between women specializing vs non-specializing (split of parental leave) is small
- Fathers who take paternity leave also face a penalty

→ **No one can compete with the 'specializing' fathers**

» Event Studies by Parental Leave

What can the workplace do?

- 'Wet' fields require lab work and presence in the office (high share of women)
- 'Dry' fields require a desk and a computer (low share of women)

→ **Child penalties in publications are smaller in the fields with flexible working arrangements. But no differences in survival and tenure rates**

» Event Studies by Wet vs Dry Fields

■ Estimating child penalties on the universe of PhD students

- We find an 18 % gender gap in the likelihood of working at universities
- Parenthood reduced the likelihood of having a tenured position by 21%
 - The penalty is reduced by 50% when conditioning on staying in academia
 - While mothers publish 20% less than fathers, controlling for publications hardly alters the tenure penalty

- Following Kleven et al (2024): Children explain 90 % of women's under-representation ... and 39 % of the gender gap in tenure rates

→ Initiatives that want to improve the share of women in junior positions should focus on parenthood. Gaps in tenure rates require broader considerations

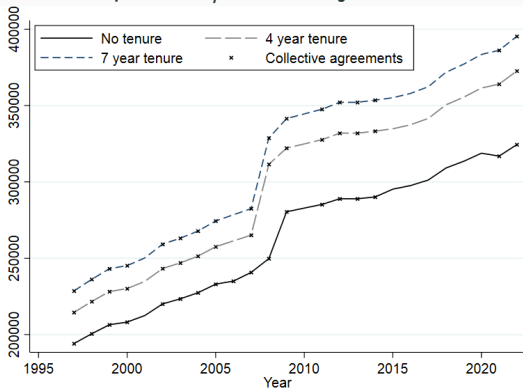
Thanks for your attention!
anne.sophie.lassen@wzb.eu

APPENDIX

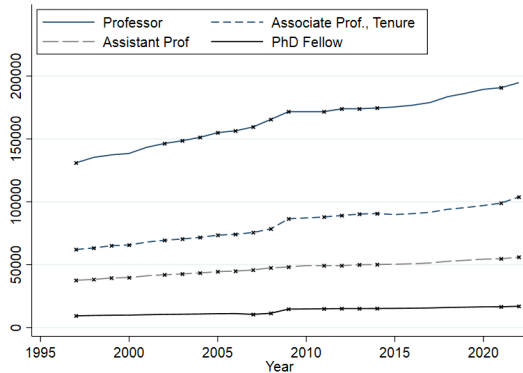
Inferring Positions from Centralized Wage Setting

Earnings for academic positions are set via collective bargaining between unions and universities

Experience/tenure adjustment



Base wage



Higher wages are possible as a result of yearly bonuses or administrative responsibilities

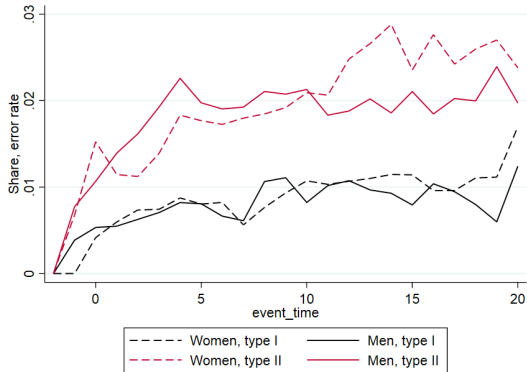
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Validating the Measure of the Position of the Researcher

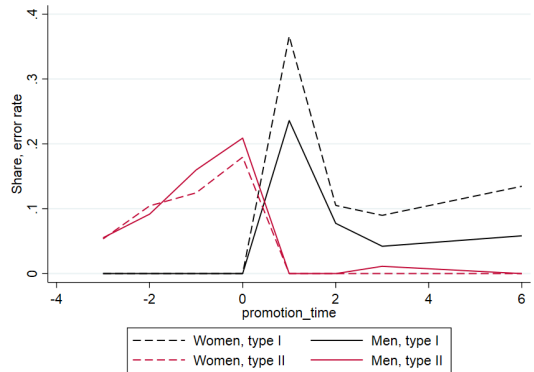
- We use payslip data that has exact position of the employee (2016-2022)
- Validating against payslip data, we find small gender difference (less than 1 pp)
 - of which the majority are juniors classified as seniors cf. bonuses (type II)
 - and a smaller share are seniors earning below the senior threshold (type I).
- We overestimate senior employment equally for men and women, and around parenthood.
- Error rates around the promotion year (according to the title on the payslip) are extremely similar for men and women

Validation

Parenthood



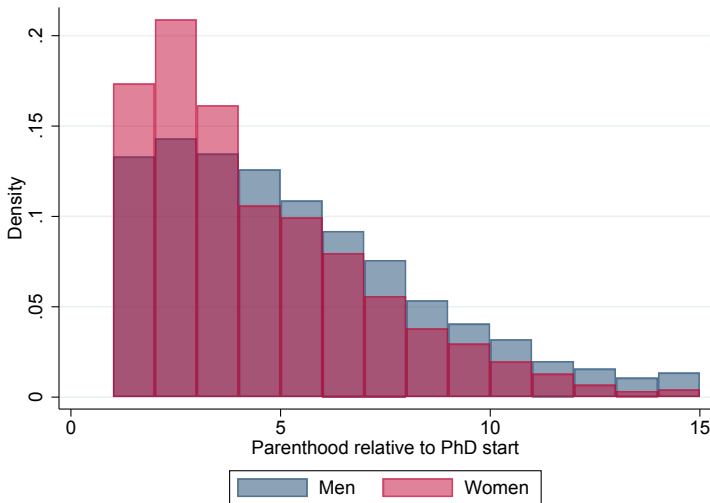
Promotion



Type I: seniors with lower earnings. II errors: juniors with higher earnings.

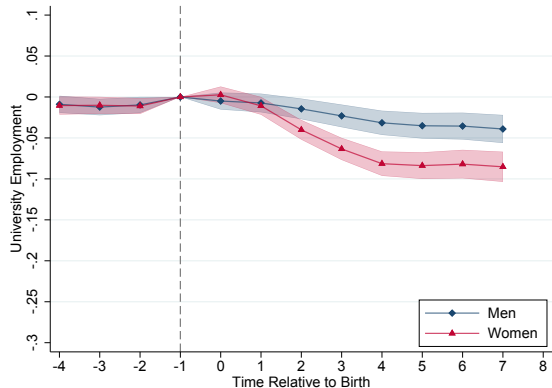
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Parenthood Patterns Relative to PhD Start (by Sex)

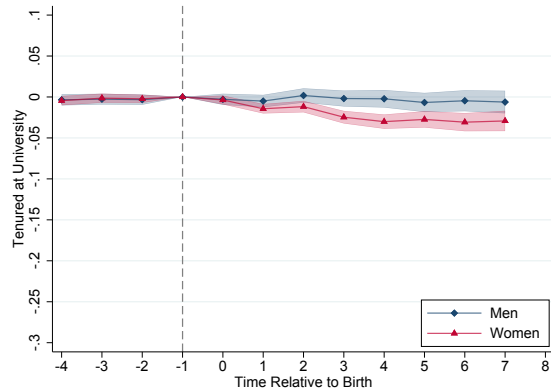


Event Studies without Counterfactual

University Employment

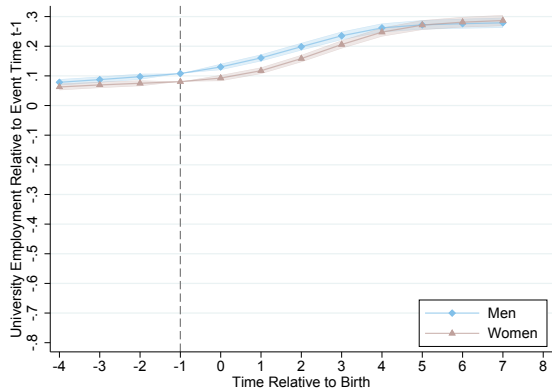


Tenure Rates

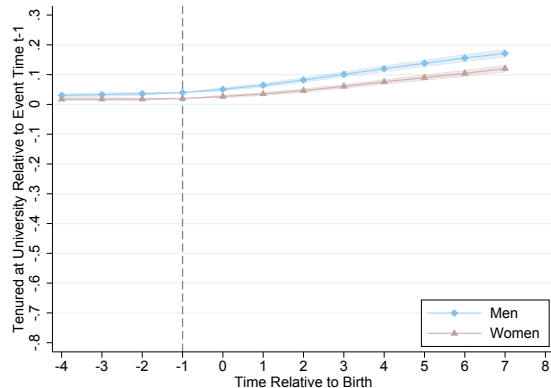


Counterfactual, Net of Children

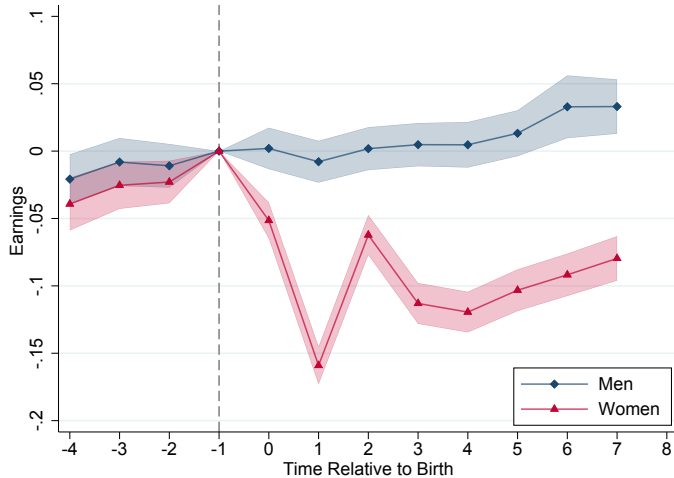
University Employment



Tenure Rates

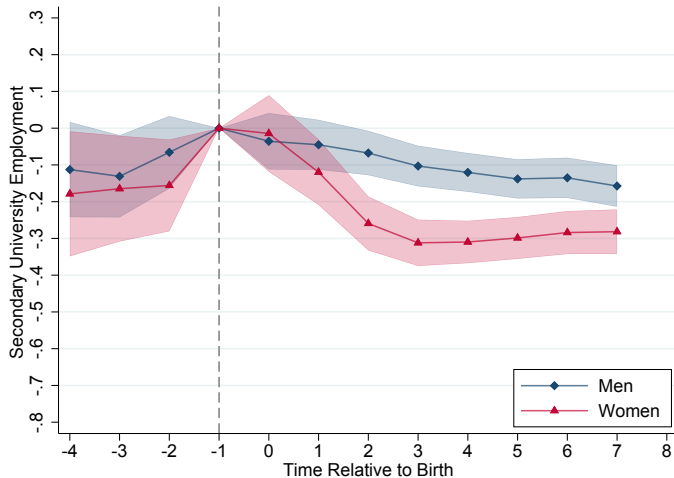


Labor Market Earnings



Labor market earnings, excl. parental leave benefits [» Back](#)

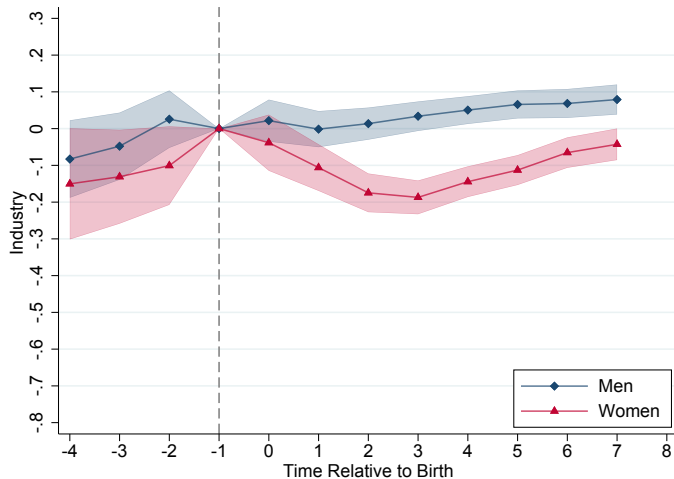
Part-time university employment



Any employment (not the largest pension contributions) at a university

[» Back](#)

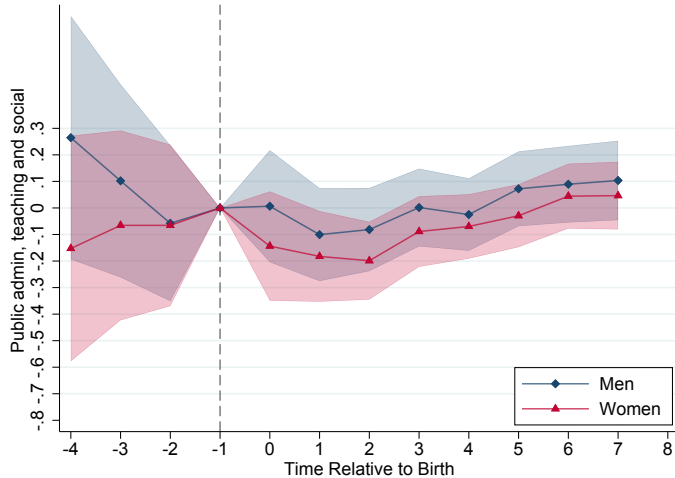
Industry employment



All NACE codes excl. research and public admin, teaching, and health.

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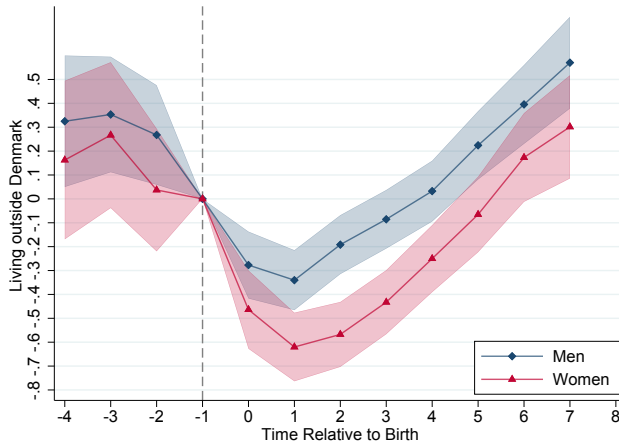
Public Sector



NACE codes: public admin, teaching, and health.

» Back

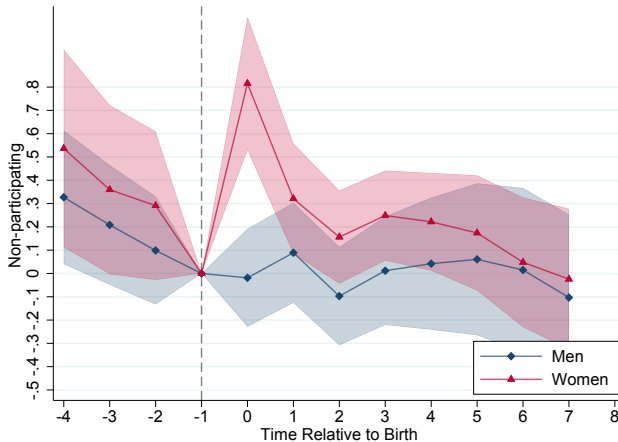
Going Abroad



Not present in Danish administrative data

In t-1, 4.0 % of women (5.2 % of men) work live outside Denmark.

Labor Market Non-Participation



No labor market earnings

In t-1, 0.8 % of women (0.6 % of men) work live outside Denmark.

Employment in Broader Research and Universities

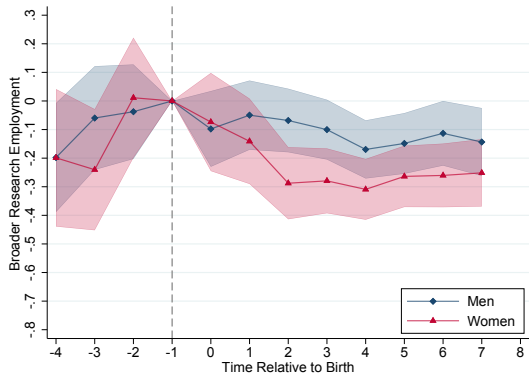


Figure 1: Broader Research

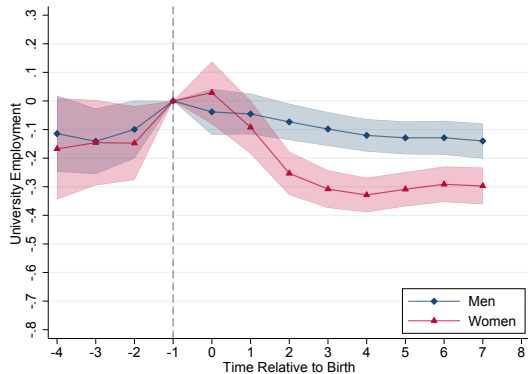
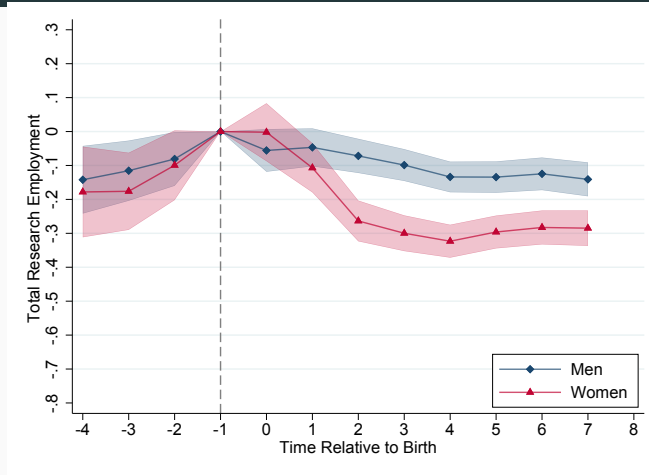


Figure 2: University

» Research

» Drivers

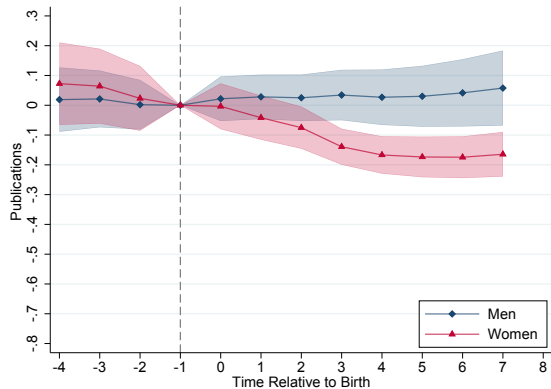
All Research (University or Broader Research)



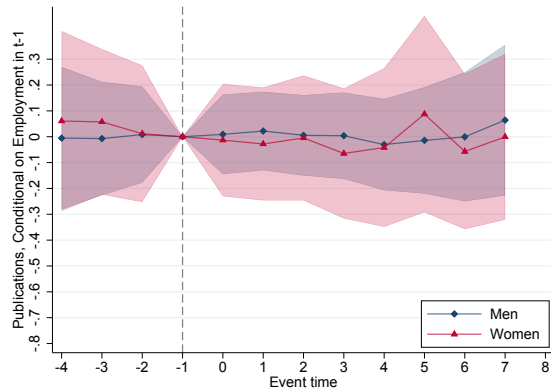
In t-1, 11.1 % of women (14.8 % of men) work in research.

Postponing Parenthood to After the PhD? Publications

Everyone

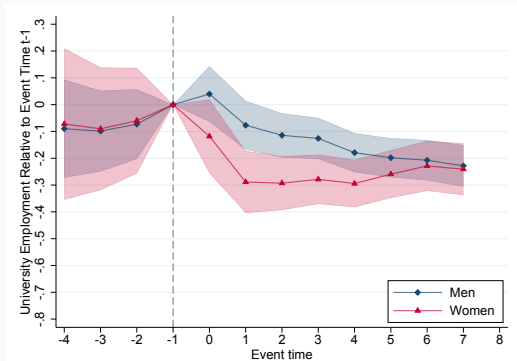


Conditional on University emp. in t-1

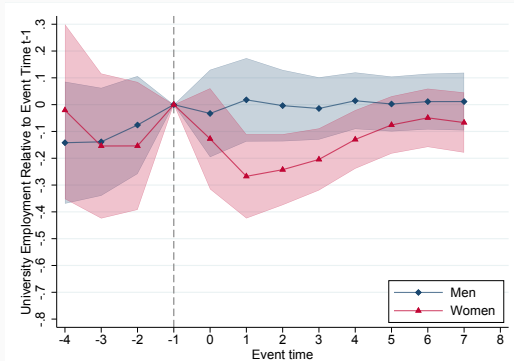


Split of Parental Leave

The father is taking some leave

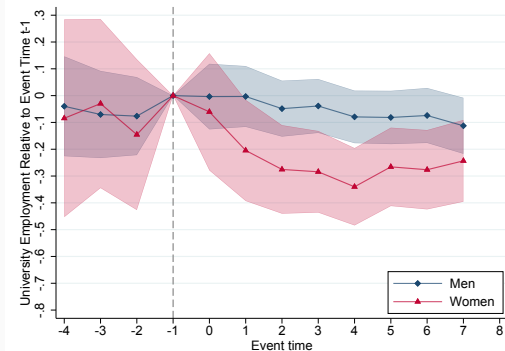


The father is taking no leave

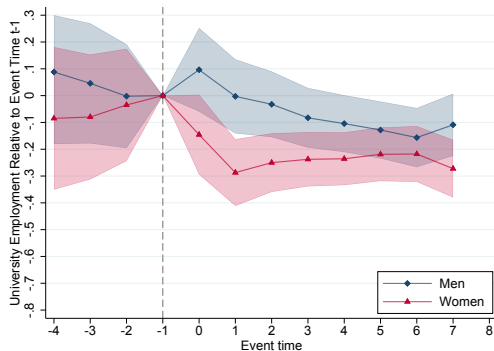


Working Conditions Don't Affect Women's Likelihood of Staying

Dry STEM fields

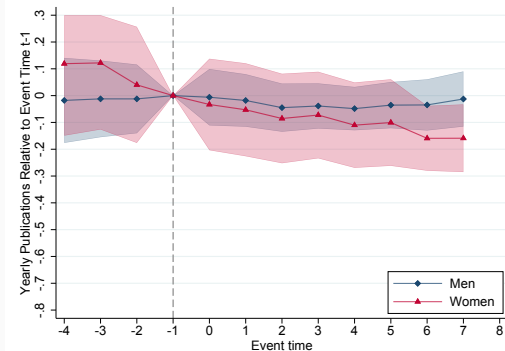


Wet STEM fields



But Fathers in Wet Fields Publish More Than Mothers in Wet Fields

Dry STEM fields



Wet STEM fields

