INDUSTRY ROBOTIZATION, FERTILITY AND PARTNERING IN SWEDEN

Linus Andersson[1] Anna Matysiak[2] Wojciech Hardy[3]

[1] Stockholm University, University of Turku

[23] Interdisciplinary Center for Labour Market and Family Dynamics (LabFam), University of Warsaw

Stockholm University

Introduction

Concerns that automation can lead to:

- Displacement of workers in manufacturing
- Lower demand of low skilled labor
- Low-quality low-skill jobs outside of manufacturing

Stockholm University

Introduction

Job loss and deteriorating work conditions due to robot displacement may lead to:

- Decrease partnering
- Postpone births

Stockholm University

Introduction

Sizable literature finds:

- (heterogenous) labor market responses to automation/digitalization/robotization

However:

- Sparse (but growing) empirical inquiry on fertility and partnering responses.

Stockholm University

Introduction

Much to learn from studying the demographic behavior of groups differentially affected by robotization!

Stockholm University

Introduction

In this project, we will:

1. Describe trends in robotization and fertility by industry across subgroups in Sweden
2. Estimate the causal effect of robotization on fertility and partnering (Shift-share research design)
3. Focus on individuals as well as couples.

Stockholm University

Introduction

In this project, we will:

1. Describe trends in robotization and fertility by industry across subgroups in Sweden
2. Estimate the causal effect of robotization on fertility and partnering (Shift-share research design)
3. Focus on individuals as well as couples.

Stockholm University

Theory

What might robotization affect?

- Routine service and manual tasks[123]
- All that is not ”engineering bottlenecks” (e.g., not high-level creative, social tasks)[123]

1 Osbourne and Frey (2017)
2 Brzeski and Burk (2015)
3 Manyika et al (2018)

Stockholm University

Theory

For Who might robotization affect fertility

- Manual & other routine task workers* (task-related)[1]
- Small(er) business (scale + super-star effects)[2]
- Low tenure employees** (WP-specific skill + legislation)[123]
- Fairly young adults (births occur in this group)[4]
- Men or women? [5]

1 Dauth et al (2017)
2 Acemugly LelLarge & Restrepo (2020)
3 Acemugly & Restrepo (2020)
4 Matysiak et al (2021)
5 Becker (1960)
*But see Dixon, Hong & Wu (2020), Keller & Uttar (2022)

Stockholm University

Theory

How might robotization affect fertility & partnering? (1)

Income vs. opportunity costs effects[1][2][3]

- Income effect stronger for men in Sweden[4]
- But Opportunity costs less important for women over time[4]

1 Becker (1993)
2 Oppenheimer (1997)
3 Wilson (1996)
3 Kolk (2020)

Stockholm University

Theory

How might robotization affect fertility & partnering? (2)

Uncertainty (beliefs about the future)[12]

- Relevant for *employed* industry workers.
- 200 years of fear of robot displacement
- Surveys indicate fear of job loss due to automation[345]
- Media ”panic discourse”

1 Vignoli (2020, 2022)
2 Friedman et al (1994)
3 Schabe & Castellacii (2020)
4 PEW RC (2017)
5 Xing (2017)
6 Markoff (NYT, 2015)

Stockholm University

Theory

Two dimensions of ”effects” of robotization

- Labor market equilibrium (displacement vs. productivity)
  - Unemployment level

- The nature of work
  - Work-life balance
  - Wages
  - Predictability
  - Status

Stockholm University

Empirical work

Trade shocks (import competition) on fertility, partnering

- (DEN) Decreased earnings, but increased fertility, decreased divorces *among women*.[1]
- *(GB)* Decreased earnings, *decrease fertility among women.* [2]
- (US) Decreased employment prospects for low-skilled, decreased marriage and fertility. [3]
- (GER) Industries negatively (positively) impacted lead to decreased (increase) fertility among low-skilled men. [4]

1 Keller & Utar (2022)
2 Aassve et al (2020)
3 Autor et al. (2019)
4 Guintella Rotunno Stella (2022)

Stockholm University

Empirical work

Robotization in industry (Shift-share and time series)

- (US) Traditional manufacturing commuting zones see birth postponement following robotization.[1]
- (US) Commuting zones with long-term migration from industry to low-skill service sector see decreased fertility. [2]
- (US) Robotization increase cohabitation and divorce with no effect on fertility. [3]
- (EU) Robotization decrease fertility in manufacturing heavy regions, heterogeneous effect in respect to education. [45]

1 Thörnqvist (2022)
2 Seltzer (2019)
3 Anelli, Giuntella, Stella (2021)
4 Matysiak et al (2022)
5 Constanzo (2021)

Stockholm University

Empirical work

Some research gaps in the study of robotization and fertility

- Few (none?) micro-level studies on the role of robotization for fertility
- Attention to heterogeneity uncovered by the LM literature
- Few studies on robotization outside the US context

Stockholm University

Present study

RQ: The association between the robotization level of industry in Sweden and individuals:

- 1st, 2nd, 3rd birth risk
- Marriage and divorce risk

Heterogeneity across

- Men and women
- Manual, Service and managerial occupations within industry
- Firm size
- Tenure

Stockholm University

Data

Register data (1993 – 2017)

- All Individuals registered in Sweden
- Vital events (births,marriages, divorces, deaths, migration) by m/yr
- Industry codes by year (~ISIC)
- Firm ID by year
- Occupational data (~ISCO08)*

International robots federation (IFR) data (1993 – 2017)

- Robot operational stock per industry cluster per year

*(2001-2017)

Stockholm University

Analytical strategy

Basic idea:

- Estimate the hazard of births, marriages, and divorces
- Contrast the risk of event of individuals employed in high vs. low robot penetration industries.
- Separately by sex, firm size, and tenure.

[1] Anelli, Giuntella, Stella (2021),
[2] Acemugly & Restrepo (2020)

Stockholm University

Analytical strategy - Robotization measure

- Yearly change in industry-specific robot stock from 1993 divided by N industry-specific employed

$$\frac{M_{i,t} - M_{i,1993}}{L_{i,1993}}$$

- Adjusted by g, industry-level growth output [1] (EU-KLEMS)

$$\frac{M_{i,t} - M_{i,1993}}{L_{i,1993}} - g_{i,(1993,t)} \frac{M_{i,1993}}{L_{i,1993}}$$

- Captures labor replaced by robotization

[1] Acemoglu & Restrepo (2020)

Stockholm University

Analytical strategy – Survival analysis

- Piece-wise constant exponential model

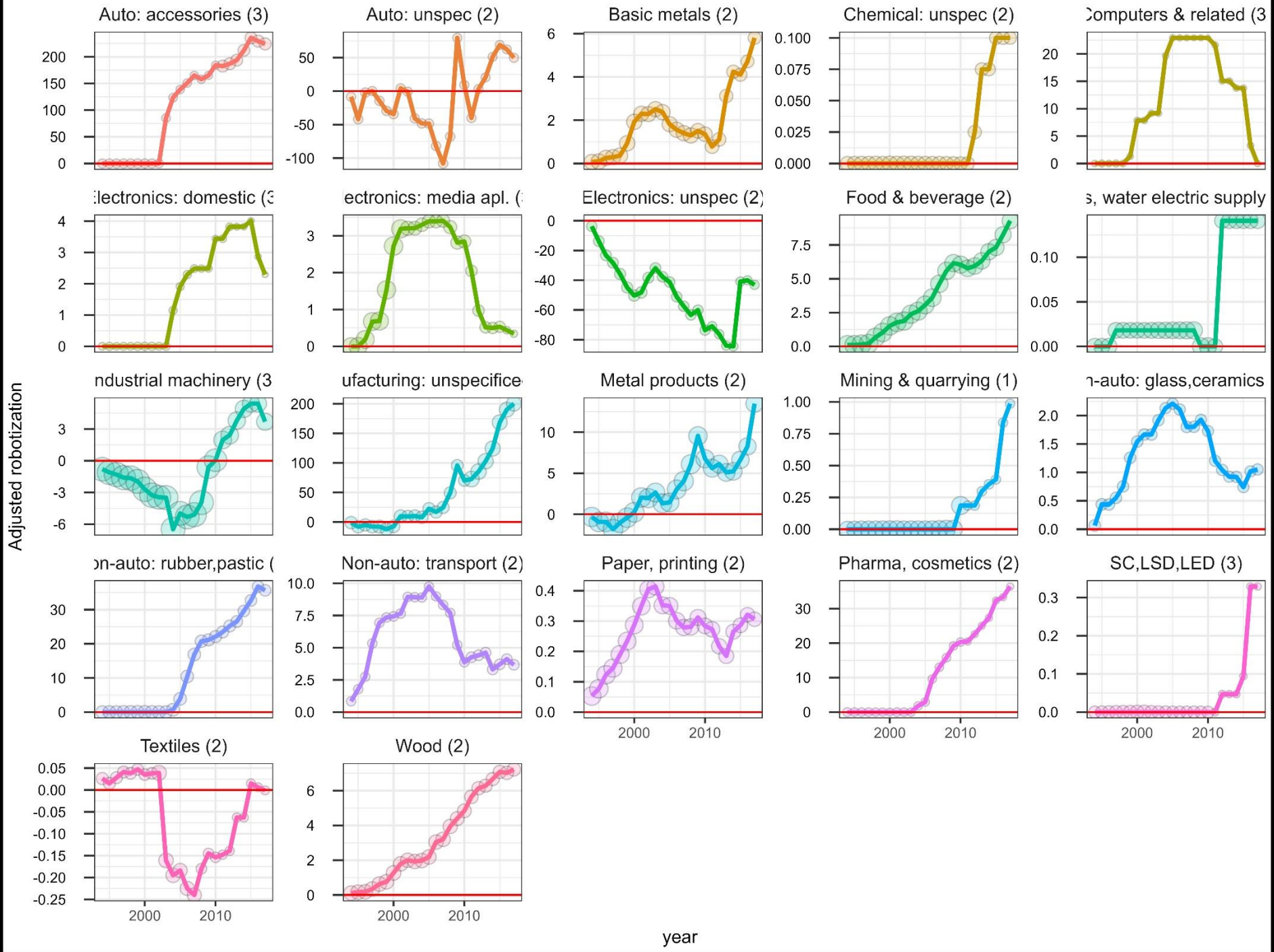
$$h(t|X) = h_0(t) \times \exp(\beta_{\text{Robotization}})$$

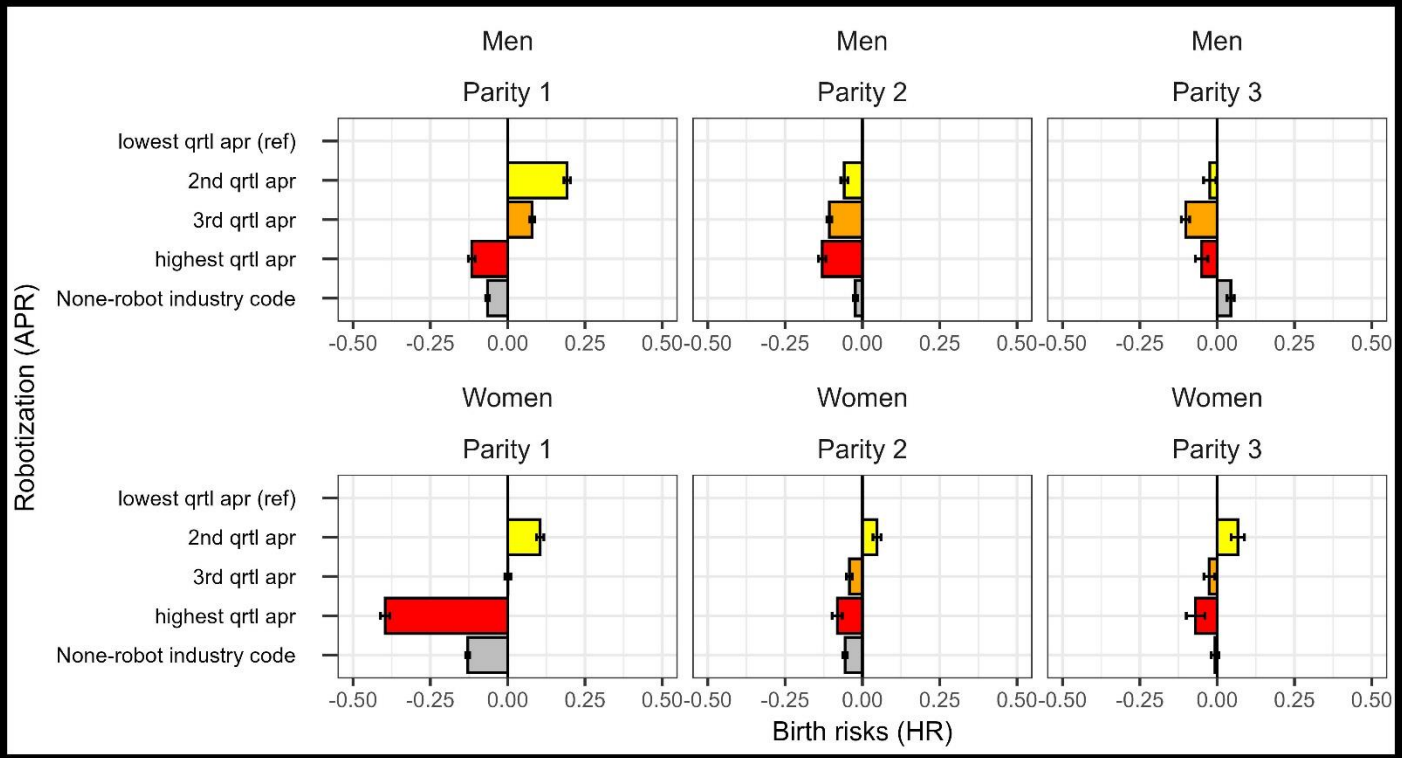
- $\beta_{\text{Robotization}}$: categorize robotization rate$_{i,t}$ by its 2017 quartiles
  - Lowest (Reference category)
  - 2nd
  - 3rd
  - Highest
  - Industry without robots during obs. period
  - Non employment

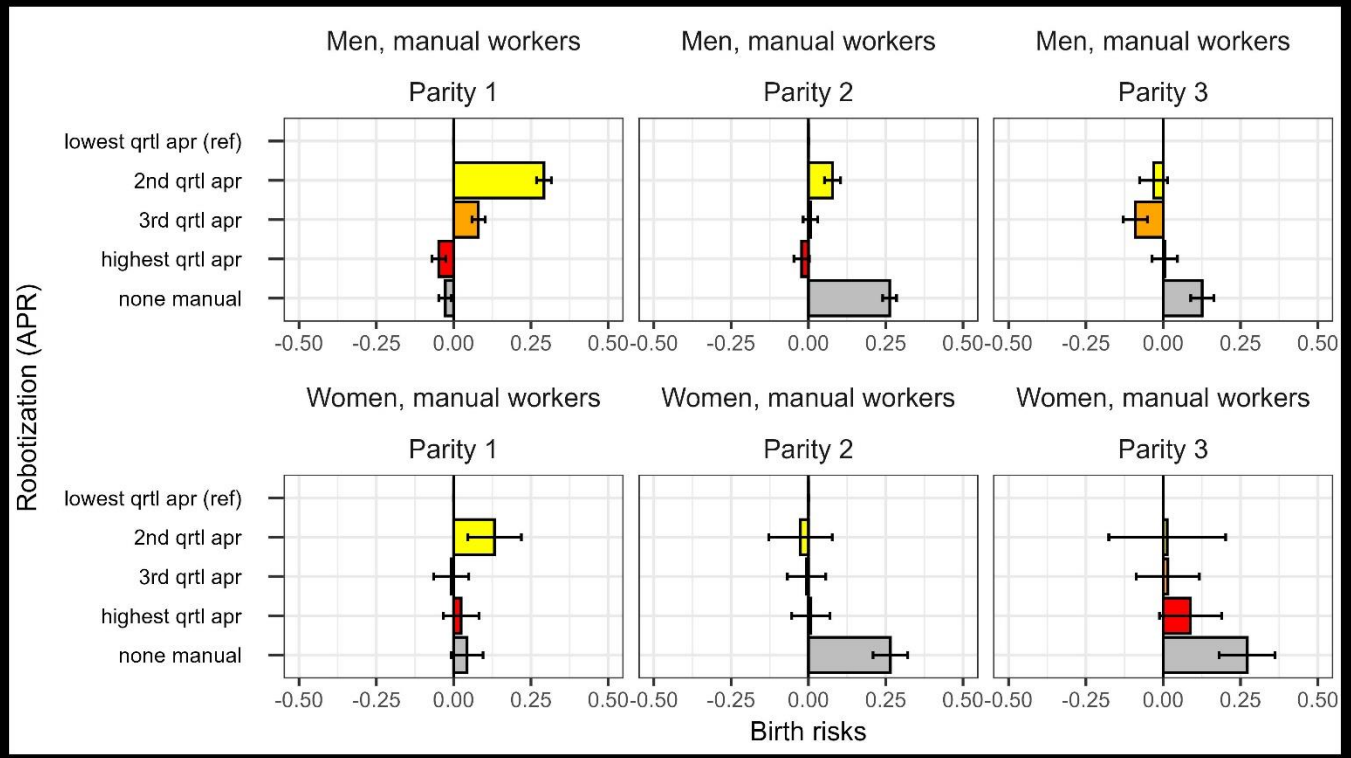
Stockholm University

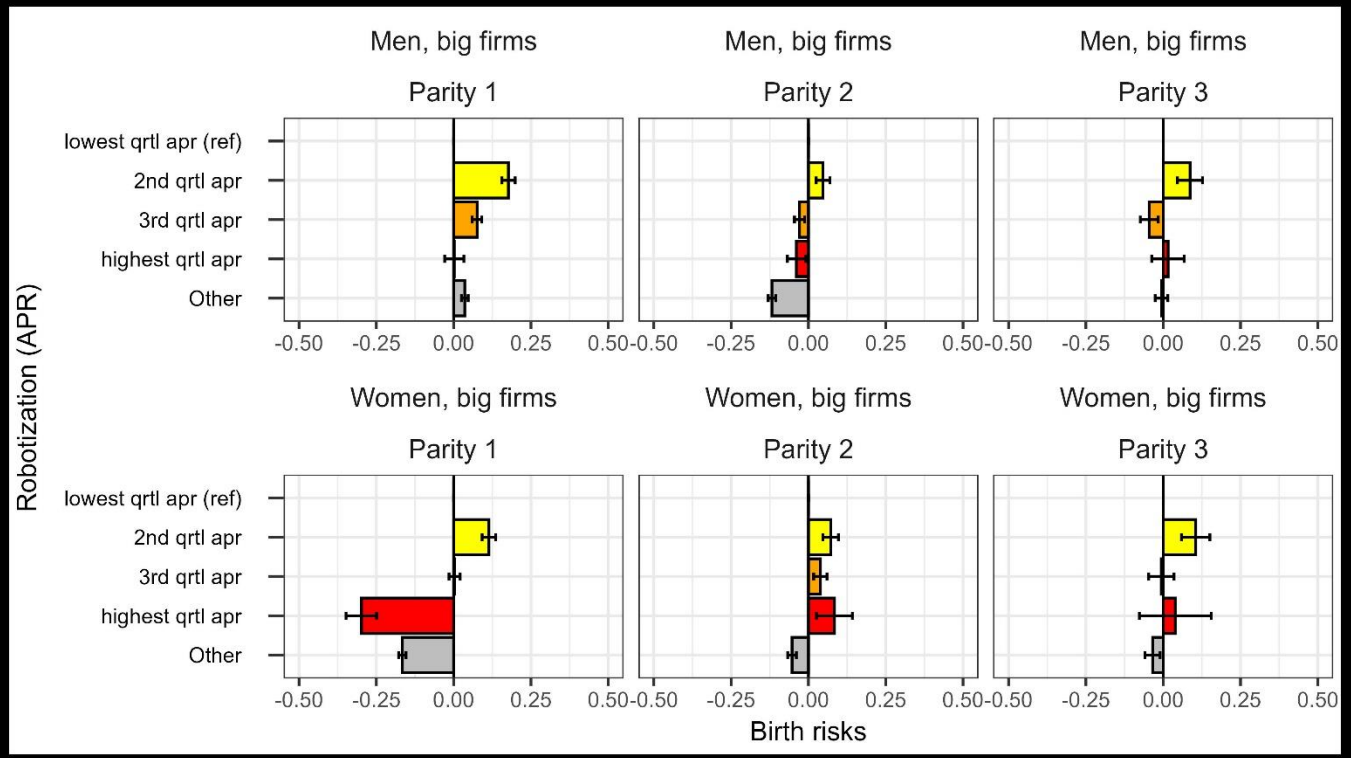
Preliminary results

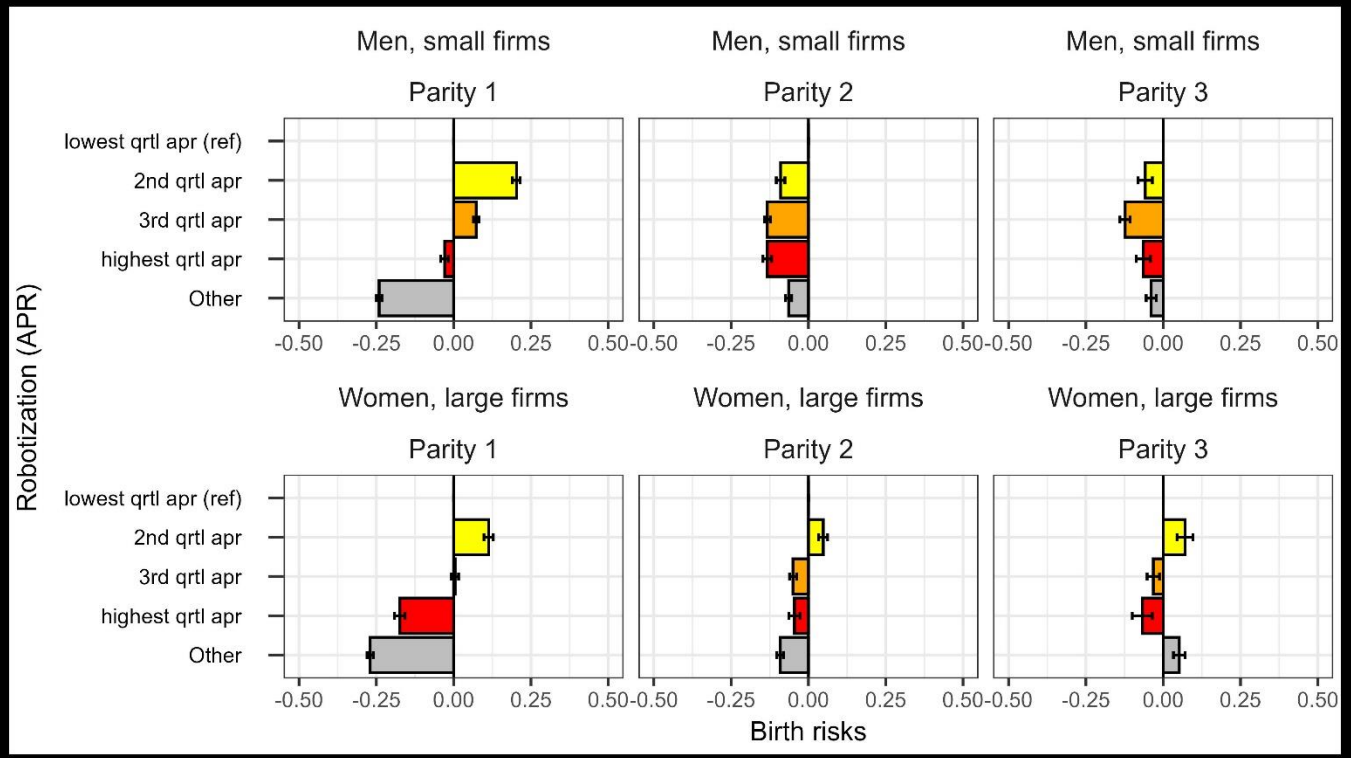
Stockholm University

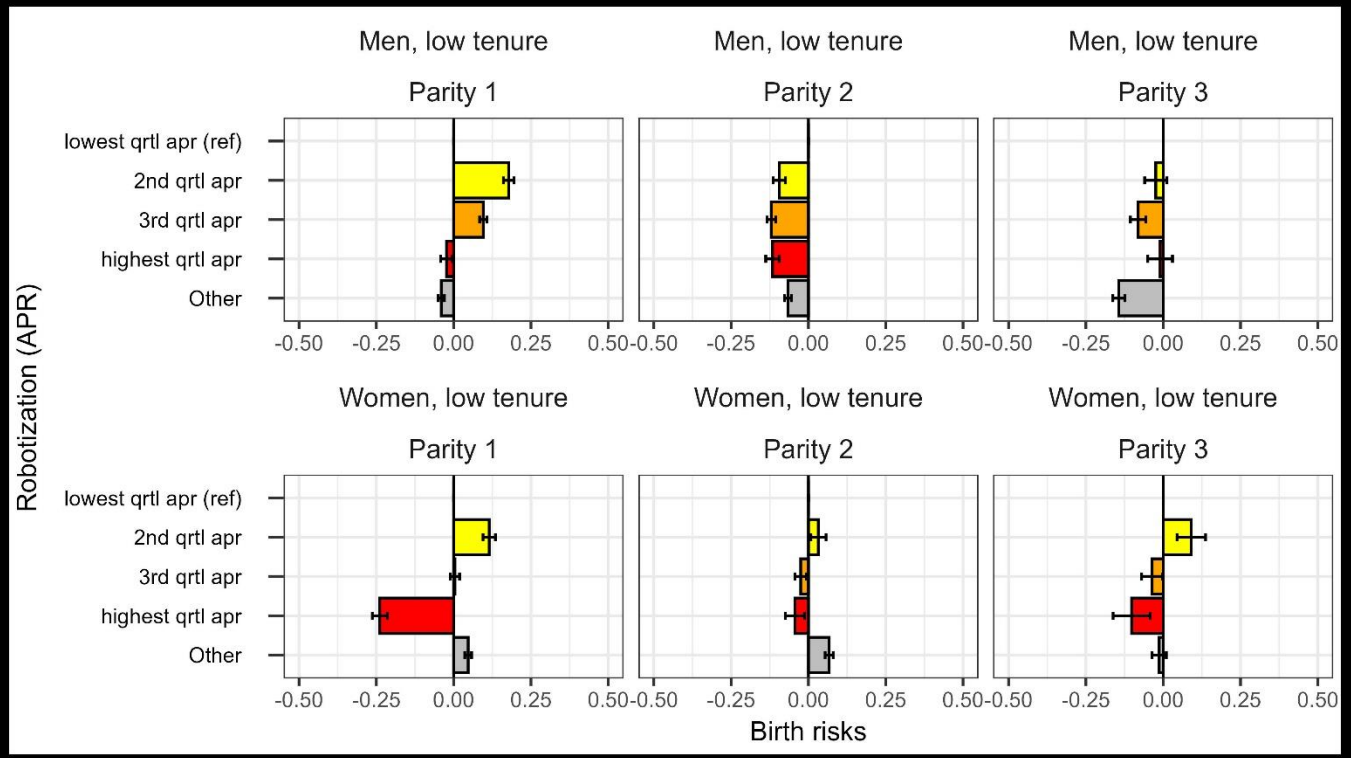

Auto: accessories (3)
Auto: unspec (2)
Basic metals (2)
Chemical: unspec (2)
Computers & related (3
lectronics: domestic (3
ectronics: media apl. (
Electronics: unspec (2)
Food & beverage (2)
s, water electric supply
ndustrial machinery (3
ufacturing: unspecifice
Metal products (2)
Mining & quarrying (1)
n-auto: glass,ceramics
on-auto: rubber,pastic (
Non-auto: transport (2)
Paper, printing (2)
Pharma, cosmetics (2)
SC,LSD,LED (3)
Textiles (2)
Wood (2)
Adjusted robotization
year
2000
2010

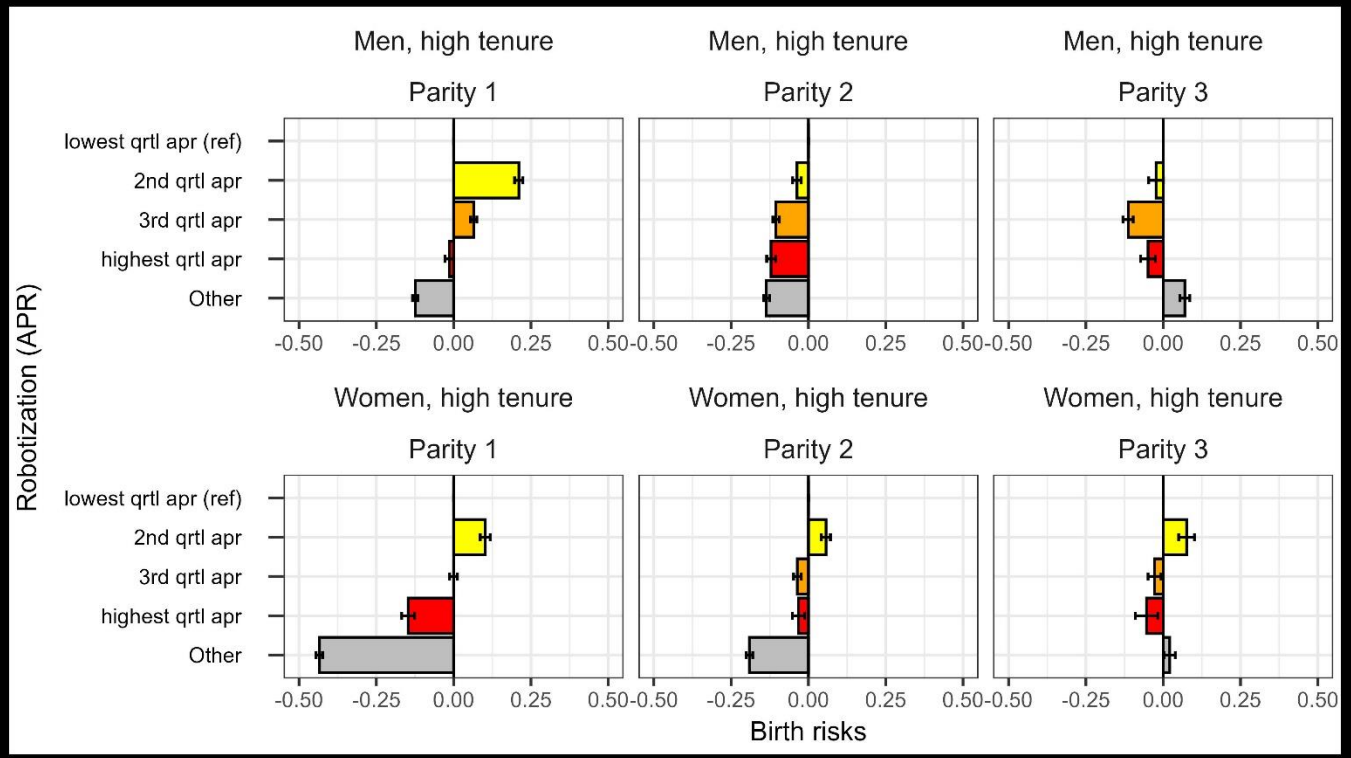

Men
Parity 1
Men
Parity 2
Men
Parity 3
Women
Parity 1
Women
Parity 2
Women
Parity 3
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
None-robot industry code
-0.50
-0.25
0.00
0.25
0.50
Robotization (APR)
Birth risks (HR)

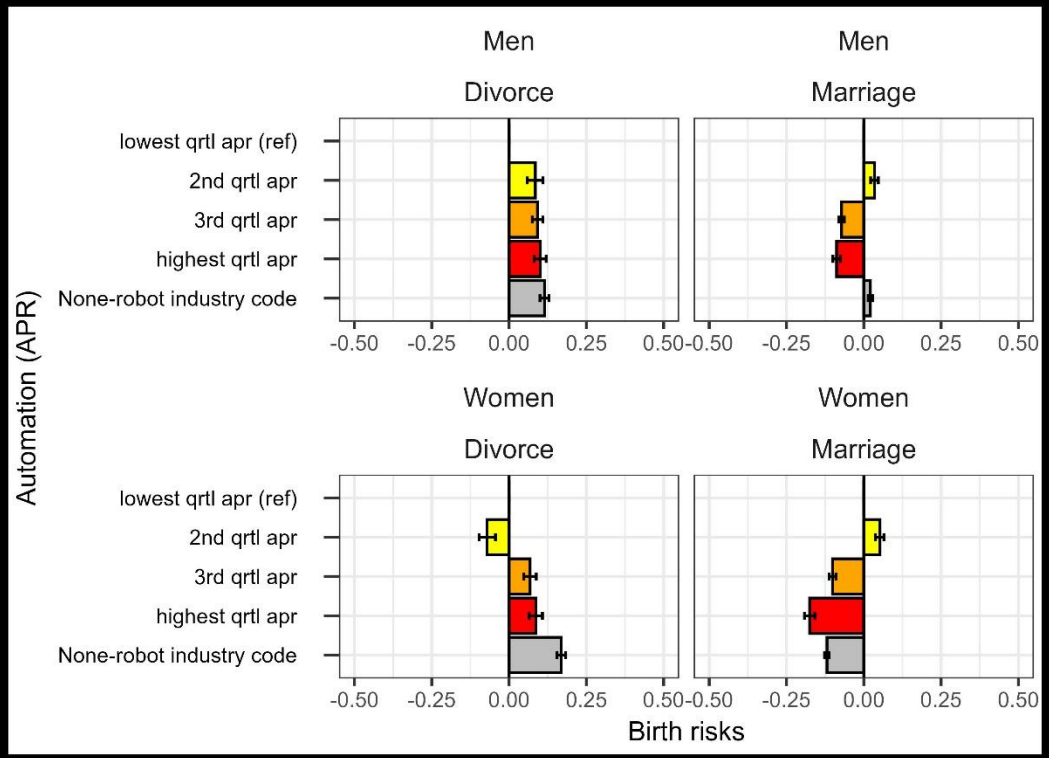

Men, manual workers
Parity 1
Men, manual workers
Parity 2
Men, manual workers
Parity 3
Women, manual workers
Parity 1
Women, manual workers
Parity 2
Women, manual workers
Parity 3
Robotization (APR)
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
none manual
-0.50
-0.25
0.00
0.25
0.50
Birth risks

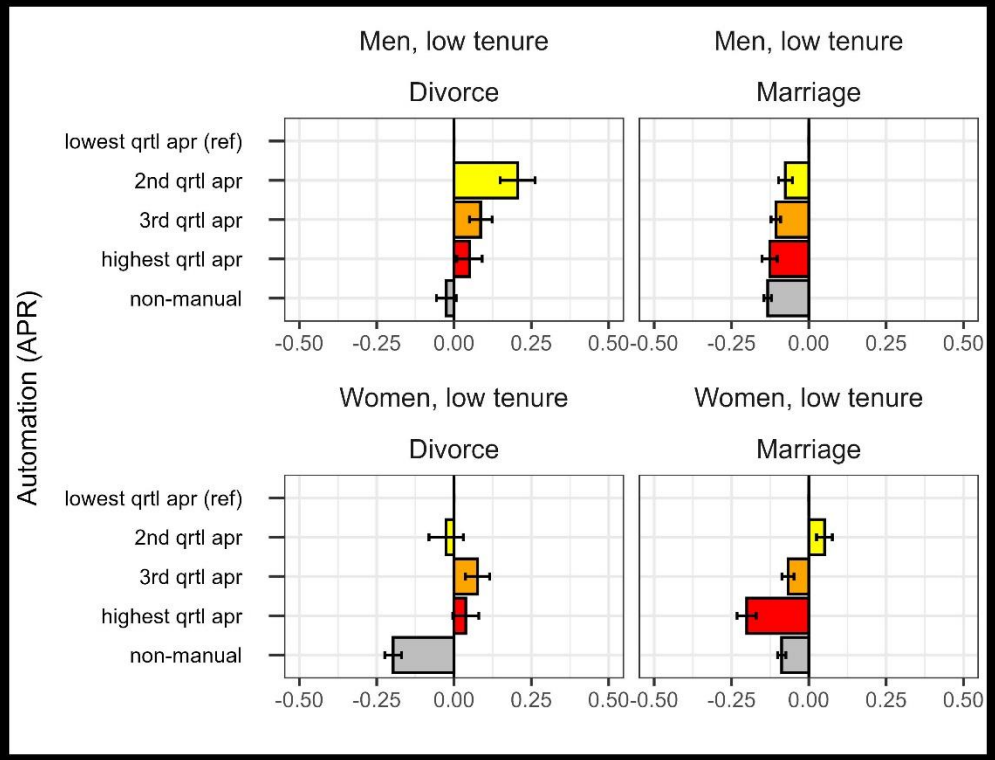

Men, big firms
Parity 1
Men, big firms
Parity 2
Men, big firms
Parity 3
Women, big firms
Parity 1
Women, big firms
Parity 2
Women, big firms
Parity 3
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
Other
-0.50
-0.25
0.00
0.25
0.50
Robotization (APR)
Birth risks

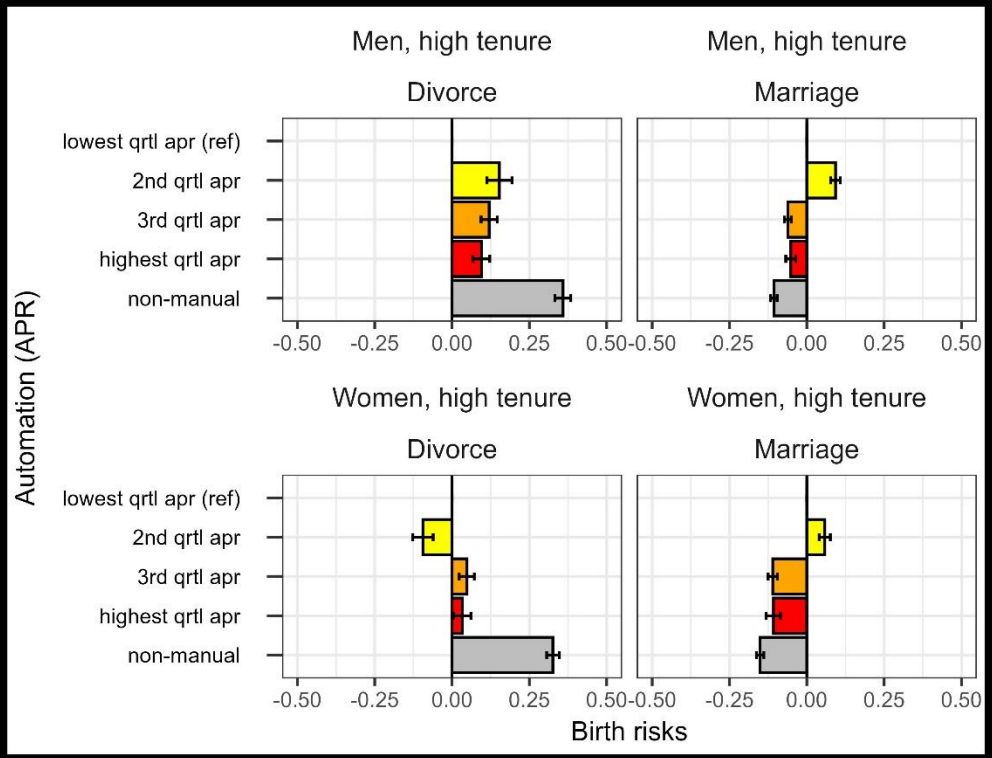

Men, small firms
Parity 1
Men, small firms
Parity 2
Men, small firms
Parity 3
Women, large firms
Parity 1
Women, large firms
Parity 2
Women, large firms
Parity 3
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
Other
-0.50
-0.25
0.00
0.25
0.50
Robotization (APR)
Birth risks

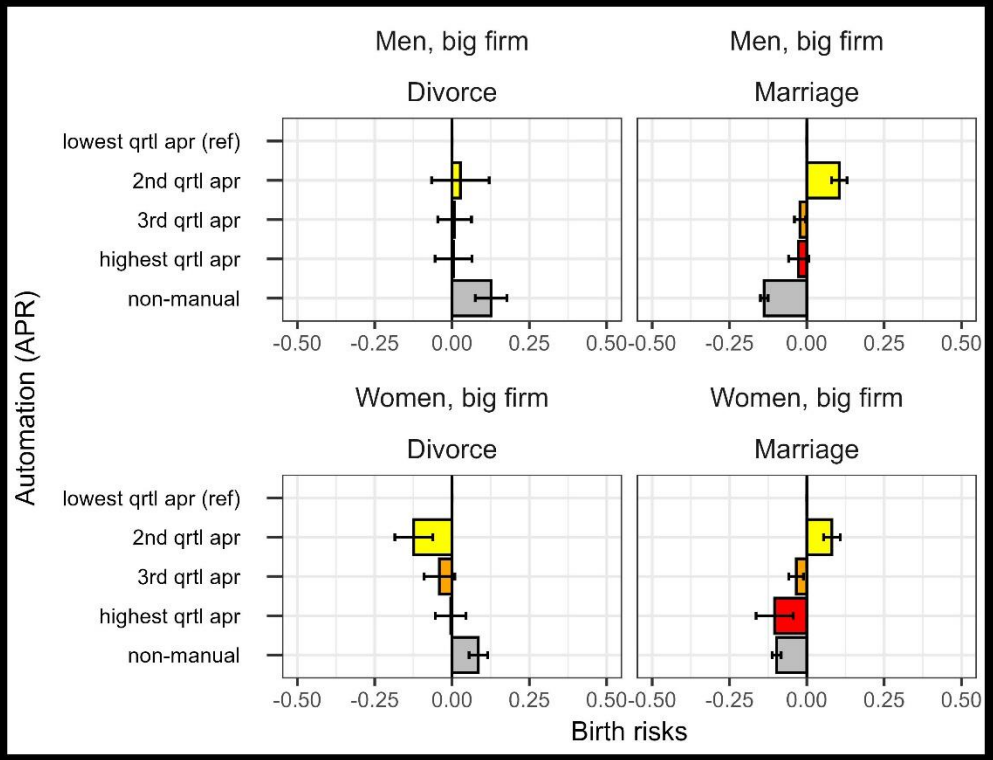

Men, low tenure
Parity 1
Men, low tenure
Parity 2
Men, low tenure
Parity 3
Women, low tenure
Parity 1
Women, low tenure
Parity 2
Women, low tenure
Parity 3
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
Other
-0.50
-0.25
0.00
0.25
0.50
Robotization (APR)
Birth risks

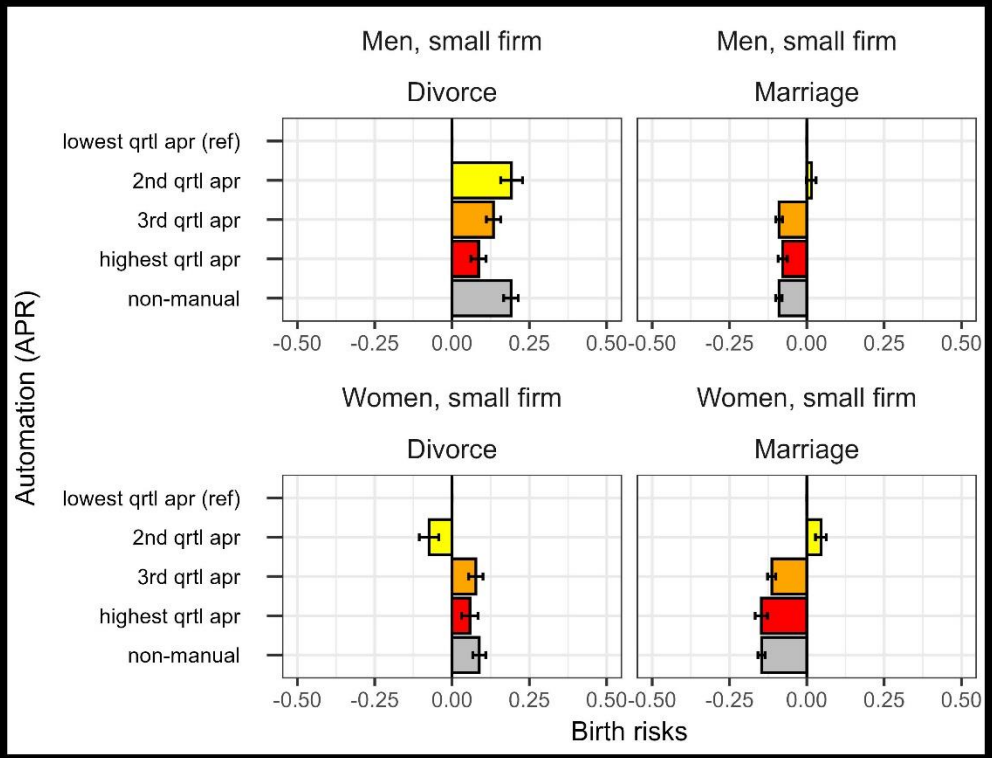

Men, high tenure
Parity 1
Men, high tenure
Parity 2
Men, high tenure
Parity 3
Women, high tenure
Parity 1
Women, high tenure
Parity 2
Women, high tenure
Parity 3
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
Other
-0.50
-0.25
0.00
0.25
0.50
Robotization (APR)
Birth risks


Men
Divorce
Men
Marriage
Women
Divorce
Women
Marriage
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
None-robot industry code
Automation (APR)
-0.50
-0.25
0.00
0.25
0.50
Birth risks


Men, low tenure
Divorce
Men, low tenure
Marriage
Women, low tenure
Divorce
Women, low tenure
Marriage
Automation (APR)
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
non-manual
-0.50
-0.25
0.00
0.25
0.50


Men, high tenure
Divorce
Men, high tenure
Marriage
Women, high tenure
Divorce
Women, high tenure
Marriage
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
non-manual
-0.50
-0.25
0.00
0.25
0.50
Automation (APR)
Birth risks


Men, big firm
Divorce
Men, big firm
Marriage
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
non-manual
-0.50
-0.25
0.00
0.25
0.50
Women, big firm
Divorce
Women, big firm
Marriage
Automation (APR)
Birth risks


Men, small firm
Divorce
Men, small firm
Marriage
Women, small firm
Divorce
Women, small firm
Marriage
lowest qrtl apr (ref)
2nd qrtl apr
3rd qrtl apr
highest qrtl apr
non-manual
Automation (APR)
-0.50
-0.25
0.00
0.25
0.50
Birth risks

Results summary

Employment in the most highly robotized industries associated with:

- Lower birth risk (all parity progressions)
- Higher divorce risk
- Lower marriage risk

Industry robotization

- Challenging to measure
- Non-linear association with demographic outcomes
- Stronger relative effect for women?

Stockholm University

Next steps

Robotization measure (scaling etc)

Non-marital union dissolution

Use LM information of ego and partner (2011 on-wards)

Use regional variation (Shift Share design)

External industry show a plausible instrument?

A focus on compositional effects for aggregate TFR

Stockholm University

Thank you!

Stockholm University