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Akademie věd České republiky

Women in Science

What do we know?

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Why does the gender gap in science matter?

15%

of US inventors were women in 2024

A model-based estimate suggests that removing barriers to women’s participation in invention could raise long-run US income per capita by 14%.

Brouillette, AEJ: Macroeconomics

The Czech starting point: large employment-rate penalty of motherhood

27%

Women among Czech researchers in 2020, compared with 34% across the EU.

CZ has the lowest EU share of women among researchers (in 2020)

in business sector (14%) and in universities (36%).

A regional comparison

Czech % of women in scientist and engineers (in 2023), % women employed in science and technology (in 2022) are close to Bavaria.

Eurostat (2020–2023); EU Labour Force Survey

What general labor economics tells us about gender gaps

Greedy work

Long, inflexible hours can command disproportionate hourly rewards (C. Goldin).

Care infrastructure

Childcare and return-to-work arrangements affect gender gaps.

Institutional design

Transparency, hiring procedures and pay disclosure can change outcomes.

- Blind hiring (Goldin and Rouse, AER 2000; Åslund & Skans, ILLR 2012)
- Longer or gender-balanced short lists in hiring (Lucas et al., NHB 2021)
- Tell people wages are negotiable (Leibbrandt & List, MS 2015)
- Publicly monitor firm-specific gender wage gaps (Bennedsen et al., JF 2022)
- Disclose public salaries (Baker et al., AEJ 2023)

Three questions for today

ENTRY

Why do women and men choose different fields of study?

CAREERS

How do parenthood and academic institutions affect retention?

INTERVENTIONS

Which policies have credible evidence of an effect?

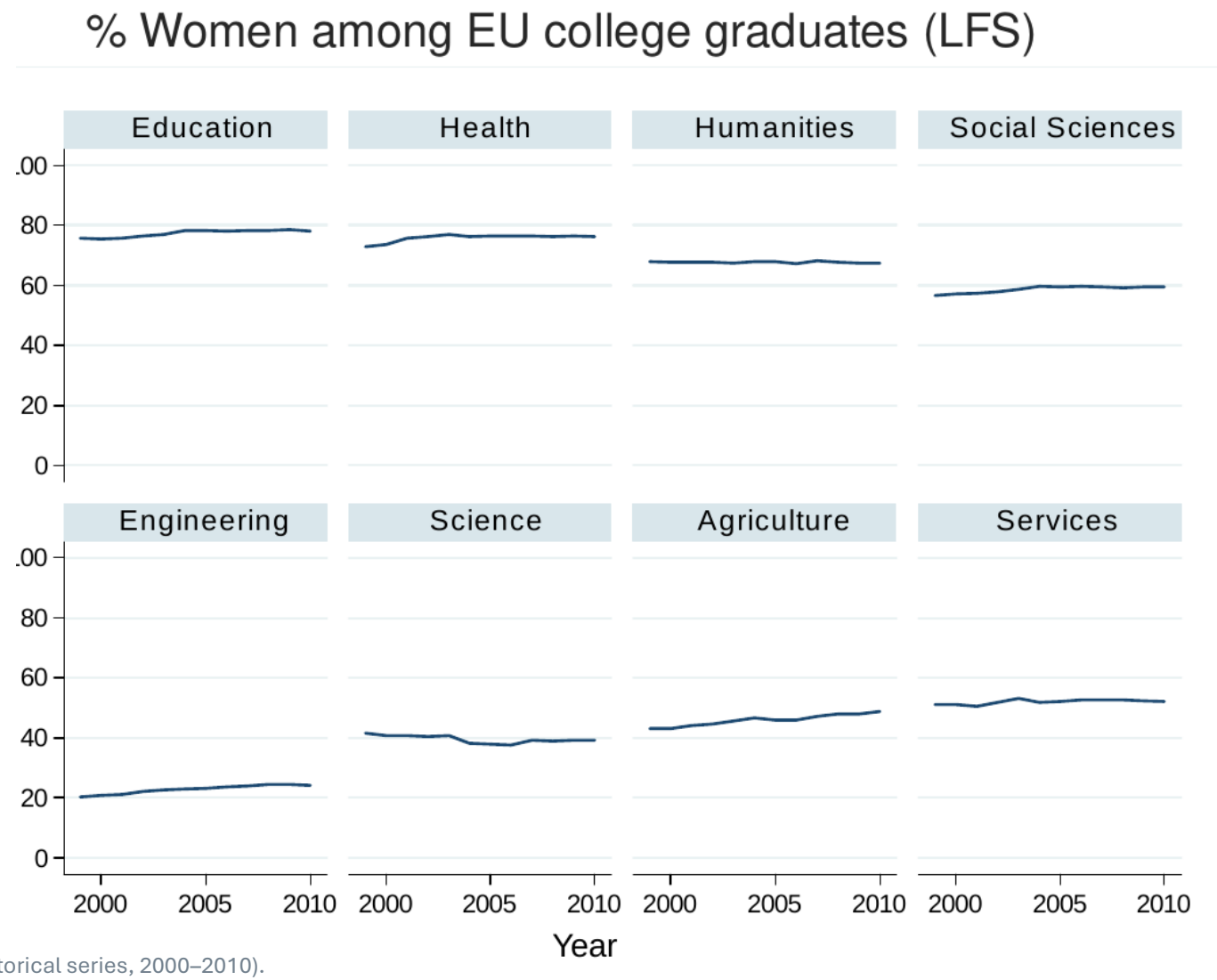
Women attend college more than men — but choose different fields

35%

of global STEM graduates are women

This share has remained broadly unchanged over the last decades, despite women’s educational gains.

European graduates: field differences persist



Source: EU Labour Force Survey (historical series, 2000–2010).

STEM pipeline gap versus choice gap

25 pp **stable lower probability of ranking STEM first**

Among academically comparable high-scoring applicants, women are less likely than men to rank STEM first. Preparedness and choice are distinct margins.

Life goals are strongly related to major choice, but gender differences in these goals are not the missing piece to the STEM gender gap puzzle.

Ahimbisibwe et al., IZA DP 18092; Leighton & Speer, IZA DP 18936

US STEM: the aggregates mask large differences

45%

Women among US STEM bachelor’s degree recipients in 2022 (35% in 1995).

35%

Women among US economics bachelor’s degree recipients in 2022 (30% in 1995).

Different disciplines

In 2020: 43% in physical/earth sciences, 26% in math/computer science, 24% in engineering.
Women earn 50% of STEM BAs, but 70% of scientists and engineers are men.

Barrera et al., Journal of Economic Perspectives (2024); NSF (2023); Mansour et al. ILLR 2022).

Recognition of women's work: a long history, mixed modern evidence

- In academia, 226 women globally in 1900. By 1914 2% of women, 1938 7%, 1956=1969 11%. Under 2% until 1969 in law, engineering, architecture.

- The "Matilda (Gage) effect" refers to the under-recognition of women's scientific contributions. Lise Meitner helped discover the fission of heavy nuclei; Otto Hahn was the sole recipient of the 1944 Nobel Prize in Chemistry for the discovery. For similar cases, see Eunice Newton Foote - CO_2 and global warming, Rosalind Franklin – DNA structure, etc.

- Some studies find convergence in conditional citation and promotion gaps after 2000. Others document persistent under-citation across many fields and changing patterns over time. The critical difference in how to approximate citation potential – compare similar papers/topics.

Recognition of women's work: a long history, mixed modern evidence

- After 2000, gender gaps in citations and promotions (conditional on publications) closed. Iaria, Schwarz, Waldinger (2022) based on 130 countries.

- Koffi (2026) analyzes 80 million WoS papers over 1985–2024 and finds systematic under-citation of women in half of fields. Citation gaps widened since 1985 in more fields than they narrowed. Citation gaps narrower in larger teams, but worse career outcomes (next p.)

- Female-authored studies treated favorably in some fields. Squazzoni et al. (2021) based on 145 journals.

- Abramo and D'Angelo (2025) suggest biases larger in peer review relative to bibliometrics-based evaluations.

Recognition of women's work: a long history, mixed modern evidence

- Today, there is no gender bias in initial NIH grant reviews (Forscher et al, NHB 2019, based on an experiment).
- But women in research teams still significantly less likely than men to be credited with authorship in most fields / career stages (Ross et al., Nature 2022).
- Getting a PhD in a field with larger avg. team size leads to worse tenure prospects for women (Andalón et al., NBER no. 32827).
- Bias against women in teaching ratings, salaries (Ceci, Kahn & Williams, 2023).

Other studies: Ferber (1986, 1988), Long (1992), Duch et al. (2012), Maliniak et al. (2013), Ceci et al. (2014), Caplar et al. (2017), Dion et al. (2018), Lynn et al. (2019), Card et al. (2020), Dworkin et al. (2020), Hofstra et al. (2020), Odic et al. (2020), Chatterjee and Werner (2021), Koffi (2021), Wang et al. (2021), Hengel and Moon (2022), Lerman et al. (2022), Teich et al. (2022), Iaria et al. (2024), Yan et al. (2024), Koffi (2025)

Why apparently conflicting results can coexist

Different outcomes

Citations, authorship, tenure, grants and publication records are not interchangeable.

Different comparisons

Unconditional gaps need not agree with gaps conditional on field, output or career stage.

Different populations and periods

Evidence for economics, NIH grants and science as a whole may differ.

Economics: publication and career selection

- To understand citation differences in top journals, control for specific research areas.
- Some evidence suggests favorable treatment of marginal female candidates after 2000.
- Women publish fewer papers partly because their observed publishing careers are shorter.

Conde-Ruiz et al. (2025); Johannesen & Muchardt (2024); Ayarza & Iriberri (2024)

Women in Economics:

- Female-authored papers, take 9 weeks longer to get accepted (for the same research quality, Bruns et al., IZA DP17649) and have higher readability scores (Hengel, 2020), suggesting that women still overcome higher hurdles to publish.
- Women get less credit in tenure decisions for collaborative work (Sarsons, AER 2017, 21 JPE), so they collaborate less (Ductor et al., REStat 2023).
- Conde-Ruiz, Ganuza, and Garcia (2025): the (positive) gender citation gap in the “Top 5” economics journals (Card et al., 2020) disappears after accounting for research areas.
- After 2000, ‘marginal’ women favored in getting faculty positions, grants, editor appointments (Johannesen & Muchardt, 2024). Gender parity only in research-intensive schools (Ginther & Kahn, AERpp 21).
- Ayarza & Iriberri (2024) study cohorts of successful economists during 1933-2019 who have published at least once in any of 36 high-impact journals. Despite their rising share, there is a stable gap in articles published, mainly because of women’s shorter careers.

Parenthood and the academic clock

Unequal career effects

Motherhood and fatherhood can have different associations with research productivity.

A policy caution

Gender-neutral tenure-clock extensions increased men’s tenure rates but hurt women’s relative outcomes in one study.

Selection matters

Later productivity peaks among mothers who remain in science need not be causal effects of motherhood, but just result of a survival bias.

Krapf et al. (2017); Antecol et al. (2018); Kim & Moser (2021)

Parenthood

- Productivity declines for unmarried mothers, mothers before 30, mothers of two or more, and increases for untenured men after their first child is born (Krapf et al., JEBO 2017).
- While other scientists peak in their mid-thirties, mothers become more productive after 35 and maintain high productivity in their 40s-50s. Timing of peak productivity has implications for tenure. Mothers who survive in science are extremely positively selected. The late career peak is not necessarily a causal effect of motherhood.(Kim & Moser, Ecm, 2021, data on 83,000 American scientists in '*American Men of Science'* 1956).
- Gender-neutral tenure clock stops help male tenure, hurt women (Antecol et al., AER 2018)
- Covid hit mothers in science particularly hard (mothers suffered a 33% larger drop in research hours during May to July 2020 compared to fathers (Deryugina et al. AERpp 2021, a global survey of 20,000 Ph.D. holders)

Nature or norms — and competitive environments

- Gender gaps in mathematics and relative strengths across subjects vary with social norms.
- Some experiments find gender differences in willingness to enter, or performance under, competition.
- These differences are context-dependent and responsive to social and educational environments — not evidence of an innate disadvantage.

Guiso et al. (2008); Jurajda & Munich (2011); Gneezy et al. (2009); Andersen et al. (2013); Booth & Nolen (2012)

Nature or norms

- Women have a comparative advantage in reading over math at age 15. The gender math gap disappears with stronger women-friendly *social norms* (Guiso et al., Science 2008).
- Gender gap in math driven by women who believe their math ability is unchangeable, so norms drive parent's expectations on girls' academic knowledge. (Burkley et al., Personality and Individual Differences 2010).
- Women less prefer / less effective in some *competitive environments* (e.g., Jurajda & Munich, AERpp 2011), but this again depends on *social norms* and educational environment, and can be changed by interventions (Gneezy et al., Ecm 2009; Andersen, et al., REStat 2013; Booth and Nolen, JEBO 2012; Cassar et al., PNAS 2016).

Changing committee composition is not enough

Randomized committee membership

More women on university hiring/promotion committees did not improve women’s outcomes in one study.

Hiring experiments

Faculty of both genders favored an identical application for lab manager when it carried a male name.
Faculty of both genders (except econ males) preferred female applicants for tenure-track STEM positions.

Implication

Evaluator gender and evaluator behavior are different policy margins.

Bagues et al., AER (2017); Moss-Racusin et al., PNAS (2012) vs. Williams and Ceci, PNAS (2015)

Promoting women can change the pipeline

+1.5

female faculty members after 15 years

In Spanish departments, randomly promoting one woman to associate professor increases subsequent female representation and has longer-run PhD spillovers.

The study leverages random assignment of evaluators to promotion committees driving candidate's success. Promoting women affects the composition of schools.

Bagues, Makany, Vattuone & Zinovyeva (2025)

Disclosure can change evaluation behavior

3

extra Nature or Science articles

Swedish “NIH” biomedical grant evaluations in the 1990s required this much additional output for a woman to receive the same score as a man. Public disclosure was followed by the disappearance of the measured bias.

Hensvik & Nilsson (2025), CEPR DP 20210

Removing bias need not reduce research output

- After disclosure, the same evaluators placed more weight on applicants' publication records.
- Post-reform grantees outperformed pre-reform grantees more strongly in committees with greater initial bias.
- Female PhD enrollment and female health-focused research also increased.

Hensvik & Nilsson (2025), CEPR DP 20210

Role models: credible evidence for entry

- Randomly assigned female STEM professors improve female students' subsequent STEM outcomes in some settings. Similar STEM effects for female student role models.
- Female math teachers improve girls' later outcomes in studies using teacher assignment variation.
- Teachers' traditional gender views can adversely affect girls' mathematics performance.

Role models can affect stereotypes and self-expectancy / self-fulfilling prophecies.

Carrell et al. (2010); Lim & Meer (2019); Gong & Song (2018); Carlana (2019)

Role models - teachers

- Randomly assigned US math/science female professor has no impact on male students, but a big effect on female students' college performance in math/science and on likelihood of taking future math/science courses (Carell et al. QJE 2010, Mansour et al., ILLR 2022)
- In South Korea, randomly assigned 7th grade math female teachers increase female students' test scores 5 years later as well as probability of attending STEM-focused high schools (Lim and Meer, JHR 2019). Female teachers causally improve cognitive and non-cognitive outcomes for girls in China, change stereotypes (Gong & Song, JoLE 2018).
- Girls taught by (randomly assigned) teachers with traditional gender views have lower math performance in Korea, Italy (Alan et al. REStat 2018; Carlana, QJE 2019).

Role models – students like me

- Introducing US STEM students to advanced peers (of randomized gender) majoring in STEM fields promotes women's commitment to STEM careers (Stout et al., J Pers Soc Psych, 2011). Similar gender-specific effects of alumni visits in economics intro classes on taking more econ courses (Patnaik et al., NBER WP 30983).
- L'Oréal 'Girls in Science' campaign: brief information intervention in French high schools: female role models drive STEM college applications for talented female students: "most effective interventions are those that improved students' perceptions of STEM careers without over-emphasizing women's under-representation in science" (Breda et al., EJ 2023). Similar evidence for engineering field-of-study choice in Peru (Agurto et al., GLO DP 2022).

What makes a role model effective?

Competence

Students should see a credible, successful role model.

Similarity

The role model should feel relatable to the intended audience.

Attainability

Students should believe that a similar career path is possible for them.

Gladstone & Cimpian (2021

Other relevant topics not explored today

Women may be less likely to reapply after a setback. (Buser and Yuan, 2019; Wasserman, 2023; Kang et al., 2024; Aneja et al., 2026)

Workplace climate. (Folke and Rickne, 2022)

Advisor–student matching. (Hilmer and Hilmer, 2007; Gaule and Piacentini, 2018)

So why so few women in science?

ENTRY · Social norms and role models

Educational choices respond to expectations and social environments.

RETENTION · Parenthood and career timing

Inflexible career structures impose unequal costs.

ADVANCEMENT · Recognition and evaluation

Credit allocation and transparency influence scientific careers.

What can institutions do?

- Improve transparency in pay and evaluation, including documented bias.
- Make scientific careers more compatible with parenthood and return to research.
- Use well-designed role-model interventions, while evaluating their effects.
- Distinguish changes in committee composition from changes in advancement and incentives.

Selected evidence: Antecol et al. (2018); Hensvik & Nilsson (2025); Breda et al. (2023); Bagues et al. (2017)

Thank you

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