Gender and the time cost of peer review

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"Productivity paradox" in academia

- □ On average, male academics publish more papers than female academics (Symonds et al., 2006; West et al., 2012; Ductor et al., 2021).
- □ Yet evidence suggests that this gap may not be a forgone conclusion:
  - □ It's smaller in fields where research is less expensive to produce (Duch et al., 2012).
  - □ It's not very present in less prestigious publication outlets (Mayer and Rathmann, 2018).
  - □ And *how* you measure productivity matters! For example, if you measure it in terms of teaching and service to the profession/department, women may even be more productivity than men (Aldercotte et al., 2017; Guarino and Borden, 2017).

Research questions

Eventually accepted papers to top economics journals seem to take longer in peer review (Hengel 2022). We seek to better understand if, how and why this could affect women's research productivity, and study whether there's anything we can do about it.

- ☐ Do referees review papers by female authors as quickly as they review papers by male authors?
- ☐ Do women spend more time responding to referees?
- ☐ Do these gaps depend on how informed referees are about a journal's standards of acceptance and their skill and accuracy at assessing manuscript quality and writing referee reports?
    - ☐ Exploit exogenous variation in referee assignment—*i.e.*, assume referee assignment across author gender is orthogonal to referee experience—and see how the gender gaps change as referees become more experienced in reviewing for *Energy Economics*.

Data permission and extraction

- ☐ Data were obtained with the permission and co-operation of Elsevier and Richard Tol, Editor-In-Chief of *Energy Economics*
- ☐ First collected publicly available data (*e.g.*, corresponding authors' genders, institutions, citations) on full-length, regular issue articles published or forthcoming in *Energy Economics* as of April 2019.
- ☐ We then extracted the names of all referees who had ever refereed for *Energy Economics* and consolidated them. (Some referees have multiple login accounts with Elsevier.)
- ☐ We wrote a Python program that downloaded all available data from Elsevier's Editorial System (EES). It then matched records with our own databases of consolidated referees and publicly collected information using authors' names, paper titles, *JEL* codes and DOIs.
- ☐ The data we analyse are an anonymised extracted subset of these data related to review time metrics (*e.g.*, submission dates, referee notification dates, round) for **accepted papers only**.
    - ☐ Conceptual + practical reasons for looking at accepted papers only: avoid "babbling" equilibrium, large number of rejected low quality submissions, *etc.*

Manuscripts per year

□ 2,359 articles (342 female corresponding author) published in *Energy Economics*.

No. manuscripts per year

% female−authored manuscripts

— Publication year   -- Submission year
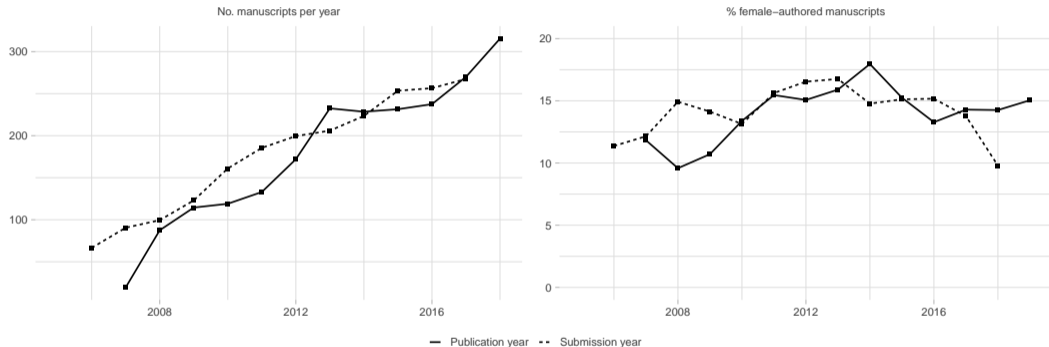
□ Increasing number of manuscripts submitted and published per year but the percentage with a female corresponding author is relatively flat.

Time spend with referees

☐ 7,464 observations of referees reviewing a paper (1,114 female corresponding author), of which 7,035 did not recommend rejection (1,038 female corresponding author).

Average no. days with referees

Distribution of days with referees, by author gender

— Publication year -- Submission year
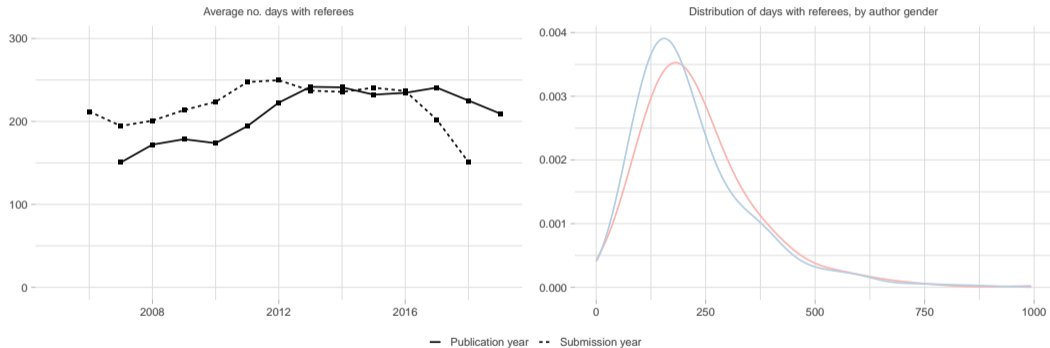
☐ Average number of total days a manuscript spends with referees has not radically changed; referees take slightly longer to review female-authored papers.

Time spend with authors

□ 3,809 observations of authors revising their papers (581 female corresponding author).

Average no. days with authors

Distribution of days with authors, by author gender

— Publication year   -- Submission year
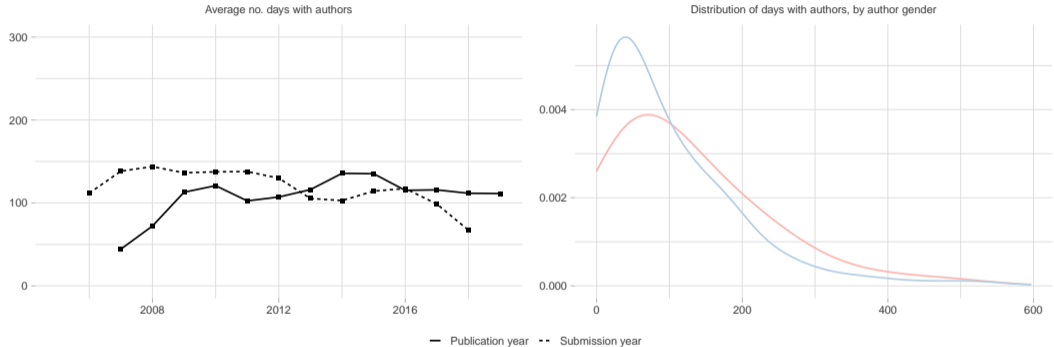
□ Average number of total days authors spend revising their manuscripts *also* has not radically changed since 2005, but again, women take longer revising than do men.

Rounds of review

Average no. of rounds

Distribution of rounds, by author gender

— Publication year -- Submission year
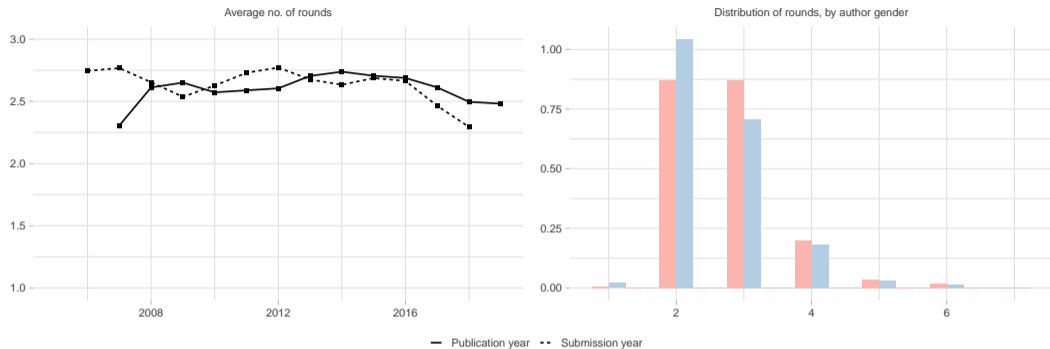
- ☐ Finally, the average number of rounds a manuscript goes through before being accepted has also remained relatively flat since 2005.
- ☐ Papers with a female corresponding author go through more rounds of review, on average.

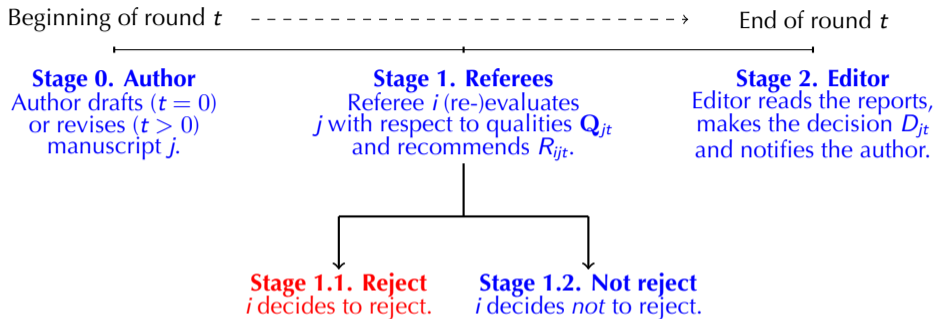# All analyses are round-specific

Beginning of round t - → End of round t

Stage 0. Author
Author drafts ($t = 0$)
or revises ($t > 0$)
manuscript j.

Stage 1. Referees
Referee i (re-)evaluates
j with respect to qualities $\mathbf{Q}_{jt}$
and recommends R_{ijt}.

Stage 2. Editor
Editor reads the reports,
makes the decision D_{jt}
and notifies the author.

Stage 1.1. Reject
i decides to reject.

Stage 1.2. Not reject
i decides *not* to reject.

☐ Article-level analysis of non-rejected papers only.

☐ Condition on several proxies for "quality", so any gender gaps we observe are between papers of roughly similar "quality" (as captured by our proxies).

☐ Captures both direct discrimination and indiret (or systemic) discrimination.

☐ Contemporaneous measure of "discrimination"/"disparty"—*i.e.*, we measure disparities created at a particular point in time—not a *cumulative* measure.

Gender differences in time spent with referees

$$\text{time}_{ijt}^R = \beta_0 + \beta_1\,\text{female}_j + \beta_2\,\mathbf{Q}_{jt} + \beta_3\,t + \tau_j + \varepsilon_{ijt}$$

	(1)	(2)	(3)	(4)
female (β_1)	4.417***	4.753***	4.725***	4.095**
	(1.658)	(1.696)	(1.692)	(1.638)
t (round)	-15.896***	-12.930***	-13.553***	-12.704***
	(0.973)	(1.346)	(1.632)	(1.57)
citations (asinh)	-5.244***			-5.216***
	(0.837)			(0.832)
R_{ijt} (referee's recommendation)				
revise (major)		8.502***		6.781***
		(1.956)		(2.238)
revise (minor)		6.568***		5.216***
		(1.515)		(1.762)
D_{it} (editor's decision)				
revise (major)			8.099***	3.230
			(2.664)	(3.078)
revise (minor)			5.738***	3.114
			(1.698)	(1.943)
No. obs.	7,035	7,035	7,035	7,035
R^2	0.083	0.070	0.069	0.087
Oster bounds (β_1)	[4.2, 4.4]	[4.8, 4.9]	[4.7, 4.8]	[3.5, 4.1]
Year (τ)	✓	✓	✓	✓

□ Controlling for current round and manuscript quality—proxied for by citations, referees' recommendations and editors' decisions—referees spend 4–5 days longer reviewing women's papers.

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□ More highly cited papers are reviewed slightly faster as are papers being reviewed in later rounds.

□ Referees are also quicker to accept than they are to recommend a revision.

Gender differences in time spent with authors

$$\text{time}_{jt}^{A} = \beta_0 + \beta_1\,\text{female}_j + \beta_2\,\mathbf{Q}_{jt} + \beta_3\,t + \tau_j + \varepsilon_{jt}$$

	(1)	(2)	(3)	(4)
female	12.282**	12.467**	12.900**	10.899**
	(5.316)	(5.515)	(5.569)	(5.295)
t	-41.537***	-28.216***	-38.156***	-27.842***
	(2.372)	(2.279)	(2.37)	(2.204)
citations (asinh)	-12.444***			-12.379***
	(1.842)			(1.765)
D_{it-1} (revise (major))		46.993***		44.464***
		(3.674)		(4.206)
D_{it}				
revise (major)			25.797***	3.232
			(7.211)	(7.409)
revise (minor)			22.514***	5.905
			(3.982)	(4.478)
No. obs.	3,814	3,814	3,809	3,809
R^2	0.112	0.133	0.105	0.151
Year (τ)	✓	✓	✓	✓

□ Controlling for year fixed effects, round and manuscript quality—citations, the editor's decision in the previous round and the editor's decision in the current round—women spend 11–13 more days revising their manuscripts during each round of review.

Gender differences in time spent with authors

$$\text{time}_{jt}^{A} = \beta_0 + \beta_1 \, \text{female}_j + \beta_2 \, \mathbf{Q}_{jt} + \beta_3 \, t + \tau_j + \varepsilon_{jt}$$

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□ In other words, conditional on the quality of the underlying manuscript, women spend longer revising than men.

Impact of referee experience
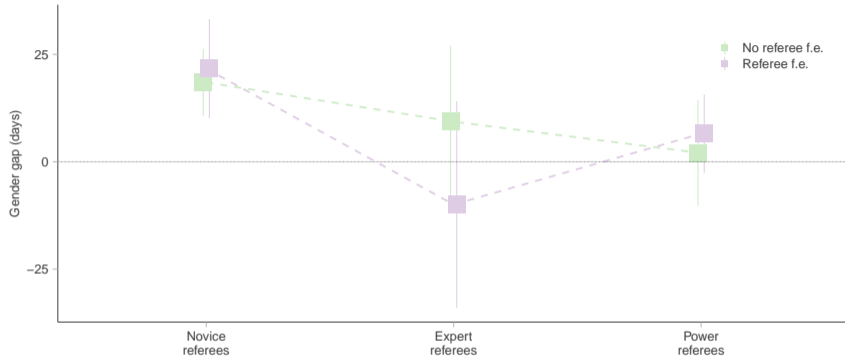
- ☐ When assigned to inexperienced referees, women spend longer than men revising their papers.
- ☐ When assigned to experienced referees, men spend as long (or longer) than women revising their papers.

Impact of referee experience
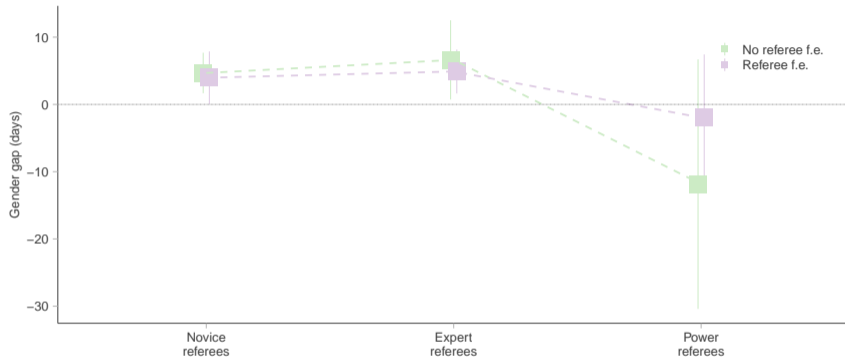
□ The review time gap also declines with referee experience, although only once one has gained *a lot* of experience refereeing for *Energy Economics*.

Impact of referee experience

	time_{ijt}^R			time_{it}^A		
	corr. author		solo-authored	corr. author		solo-authored
	(1)	(2)	(3)	(4)	(5)	(6)
female (β_1)	5.131***	4.709**	7.793**	17.159***	28.995***	45.425***
	(1.707)	(1.865)	(3.867)	(4.447)	(9.453)	(14.923)
t (round)	-15.328***	-13.801***	-15.503***	-47.499***	-58.304***	-45.511***
	(1.151)	(1.358)	(1.241)	(2.264)	(2.967)	(7.949)
citations (asinh)	-5.293***	-3.244***	-5.353***	-15.276***	-12.700***	-7.467***
	(0.743)	(1.022)	(0.786)	(1.452)	(2.737)	(2.316)
Referee experience						
experience	-0.275***	0.299	-0.276***	-0.156***	0.043	-0.171***
	(0.106)	(0.206)	(0.106)	(0.028)	(0.152)	(0.057)
experience×female	-0.094	-0.107	-0.221**	-0.114*	-0.458**	-0.997**
	(0.123)	(0.086)	(0.11)	(0.064)	(0.203)	(0.451)
No. obs.	7,035	7,035	6,167	6,440	6,440	1,170
R^2	0.094	0.630	0.091	0.106	0.687	0.099
Year (τ)	✓	✓	✓	✓	✓	✓
Referee		✓			✓	

What is going on?

- □ Exploit exogenous variation in referee assignment—*i.e.*, referee assignment across author gender is orthogonal to referee experience—and find that both gender gaps decline (and eventually disappear) as referees' experience increases.

- □ We interpret this as a form of **statistical discrimination**—which includes beliefs based on correct as well as incorrect information (direct discrimination). It also inlcudes situations in which referees have a harder time evaluating female-authored research, *e.g*, because of writing style or because "shortcuts" are less effective for evaluating female-authored research (indirect/systemic disrimination and similar to the statistical discrimination in Aiger and Cain (1977)).

    - □ Less experienced referees are less sure about the standards of acceptance and/or less knowledgeable about the process of peer review at a particular journal.
    - □ Thus, they scrutinise more heavily the papers they are (for whatever reason), *most* unsure about—*i.e.*, they "hedge" their positive decisions by writing tougher reports.

The role of institutions on time spent with referees

- Editor, referee and field fixed effects do not appear to drive $\beta_1 > 0$.

	(1)	(2)	(3)	(4)
female (β_1)	4.449***	4.169***	3.308**	8.282***
	(1.601)	(1.594)	(1.665)	(2.636)
t (round)	-15.050***	-13.332***	-13.224***	-13.516***
	(0.908)	(1.278)	(1.252)	(1.201)
citations (asinh)	-4.699***	-2.973***	-3.128***	-2.919***
	(0.846)	(0.988)	(0.868)	(0.901)
No. obs.	7,035	7,035	7,035	7,035
R^2	0.089	0.093	0.114	0.313
Year (τ)	✓	✓	✓	✓
Editor	✓	✓	✓	✓
Referee		✓	✓	✓
JEL (secondary)			✓	✓
Institution				✓

The role of institutions on time spent with referees

- Editor, referee and field fixed effects do not appear to drive $\beta_1 > 0$.
- Institution fixed effects may...
  - β_1 doubles.
  - *Also* absorb substantial variation in the dependent variable.

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No. obs.	7,035	7,035	7,035	7,035
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Year (τ)	✓	✓	✓	✓
Editor	✓	✓	✓	✓
Referee		✓	✓	✓
JEL (secondary)			✓	✓
Institution				✓

The role of institutions on time spent revising

□ Including editor and *JEL* fixed effects has no impact on the coefficient on female.

	(1)	(2)	(3)	(4)
female	11.514**	11.430**	23.575***	19.522*
	(5.352)	(5.277)	(8.032)	(10.734)
t	-42.336***	-43.428***	-45.079***	-58.873***
	(2.383)	(2.439)	(3.045)	(3.212)
citations (asinh)	-13.182***	-12.524***	-12.620***	-12.563***
	(1.857)	(1.845)	(2.793)	(3.206)
No. obs.	3,814	3,814	3,814	6,440
R^2	0.114	0.153	0.394	0.443
Year (τ)	✓	✓	✓	✓
Editor	✓	✓	✓	✓
JEL (secondary)		✓	✓	✓
Institution			✓	✓
Referee				✓

The role of institutions on time spent revising

- ☐ Including editor and *JEL* fixed effects has no impact on the coefficient on female.

- ☐ But the coefficient doubles when we account for institution fixed effects! Referee and institution fixed effects explain a great deal of variation in the dependent variable.

	(1)	(2)	(3)	(4)
female	11.514**	11.430**	23.575***	19.522*
	(5.352)	(5.277)	(8.032)	(10.734)
t	-42.336***	-43.428***	-45.079***	-58.873***
	(2.383)	(2.439)	(3.045)	(3.212)
citations (asinh)	-13.182***	-12.524***	-12.620***	-12.563***
	(1.857)	(1.845)	(2.793)	(3.206)
No. obs.	3,814	3,814	3,814	6,440
R^2	0.114	0.153	0.394	0.443
Year (τ)	✓	✓	✓	✓
Editor	✓	✓	✓	✓
JEL (secondary)		✓	✓	✓
Institution			✓	✓
Referee				✓

Not a question of institutional prestige

□ Rank institutions by the number of manuscripts published in *Energy Economics* with a corresponding author affiliated with the institution. We then grouped institutions into five roughly equally sized groups.

□ If anything, both gaps widen as institutional prestige increases.
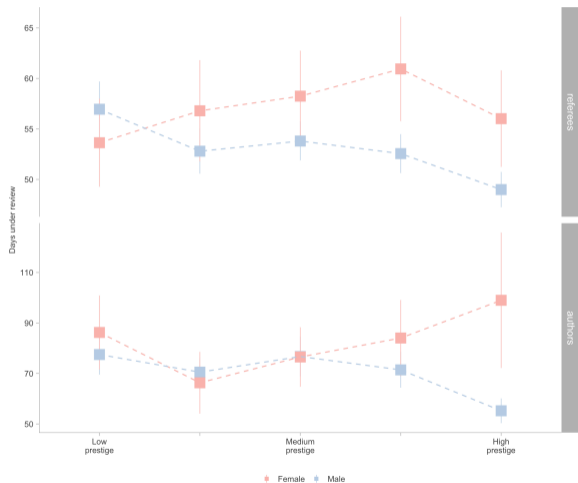
Why do the gaps increase when controlling for institutional f.e.?

☐ We suspect that institutional fixed effects are picking up unobserved heterogeneity in authors' "networks".

☐ If this hypothesis is correct, it suggests that once authors' connections are taken (at least partially) into account, then the gender gaps in time spent being reviewed and being revised widen.

☐ Or in other words, "connections" do not work as well for women as they do for men.

☐ But this is still exploratory work.

Summary

- □ Exploit exogenous variation in referee assignment—*i.e.*, referee assignment across author gender is orthogonal to referee experience—and find that both gender gaps decline (and eventually disappear) as referees' experience increases.

- □ Suggests a form of **statistical discrimination**—which includes beliefs based on correct as well as incorrect information.
  - □ Less experienced referees are less sure about the standards of acceptance at a particular journal.
  - □ Thus, they scrutinise more heavily the papers they are (for whatever reason), *most* unsure about.

- □ Identifies several potential (and preliminary!!) policy solutions!
  - □ Within referee comparisons, so the gender gap in peer review times declines as the *same referee* reviews more papers for *Energy Economics*—so increase the pool of experienced referees!
  - □ Send papers by women (and possibly also "low prestige" men) to more experienced referees (and send papers by "high prestige" men to less experienced referees).

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