To Grant or Not to Grant: Inventor Gender and Patent Examination Outcomes

Yuqi Gu, Willamette University
Katharina Lewellen, Dartmouth College
Connie X. Mao, Temple University
Yueru Qin, Nankai University

January, 2025

Gender Gap in Labor Market

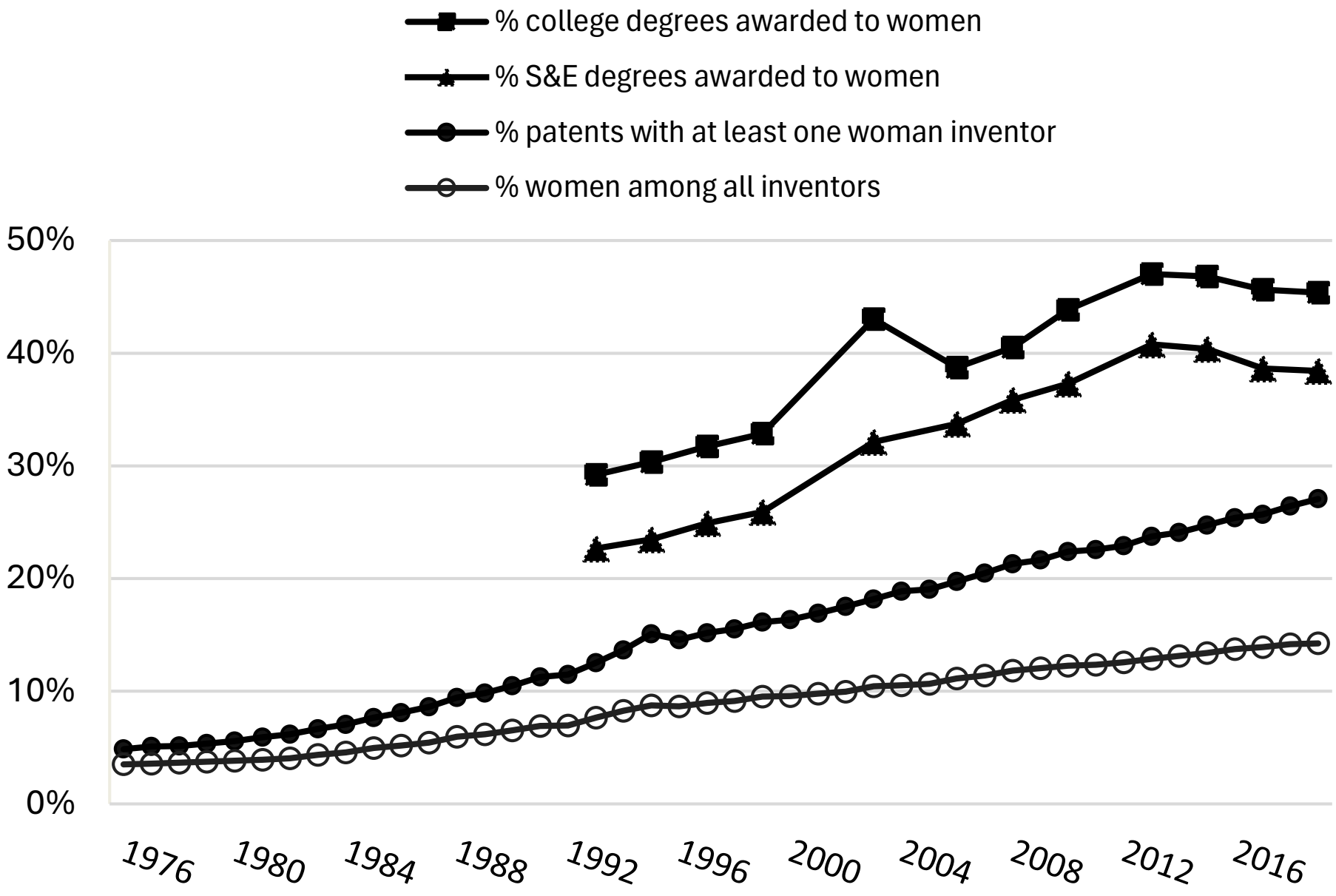
Prize in Economic Sciences for 2023 to Claudia Goldin

NEWS The Royal Swedish Academy of Sciences has decided to award the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel for 2023 (the Nobel Prize in Economics) to Claudia Goldin for having advanced our understanding of women's labour market outcomes.

"*Understanding women's role in the labor market is critical for society… If women do not have the same advantages and opportunities as men, or they participate on unequal terms, labor, skills, talent go wasted*."

Jakob Svensson
Chair, Economic Sciences Prize Committee 2023

Female Presence in U.S. Education & Patenting



Literature on Gender Gap in Professional Settings

- Gender gap within high-skill professions: Blau and Kahn (2017); Goldin (2014)

  - Finance (Egan, Matvos, and Seru, 2022),
  - Medicine (Sarsons, 2017),
  - Academia (Sarsons et al., 2021),
  - Sales (Benson, Li, and Shue, 2022),
  - Corporate leadership (Lewellen, 2024),
  - Entrepreneurship (Guzman and Kacperczyk, 2019)

- Gender gap in the patents:
  - Hegde and Raj (2022)
  - Hochberg, Kakhbod, Li, and Schdeva (2023)
  - Jensen, Kovác, and Sorenson (2018)
  - Aneja, Reshef, Subramani (2024)

Research Question

- The existence and causes of gender disparities in the patent examination outcomes
  - Patents provide a legal framework for innovation, so any frictions or biases within this framework can have significant consequences for innovation activities, output and growth.
  - Patent data includes large samples of applications within narrowly defined fields and details on how they progress through the examination process, enabling researchers to study individual decision-making and outcomes.

Examination Process of Patent Applications

- We examine gender differences in the U.S. patent examination process through which patent applications are converted to granted patents.

		All Applications	All-Female Teams	All-Male Teams
First round	Number of Applications	988,125	30,576	822,657
	Accepted (first-action allowance)	0.075	0.045	0.079
	Rejected	0.925	0.955	0.921
	Abandoned	0.152	0.255	0.149
	Amended/Appealed	0.848	0.745	0.851
Second round	Number of Applications	769,385	21,599	640,437
	Accepted	0.760	0.608	0.765
	Rejected	0.240	0.392	0.235
	Abandoned	0.387	0.552	0.376
	Amended/Appealed	0.613	0.448	0.624
All rounds	Accepted	0.685	0.489	0.697
	Rejected	0.315	0.511	0.303

Hypothesis Development (I)

- The ‘gender bias’ hypothesis
  - Theories of discrimination: Gender disparities arise due to discrimination or negative stereotypes about gender (Ridgeway and Correll, 2006; Castilla, 2008), especially in male-centric pursuits (Guiso et al. 2008; Carrell et al. 2010; Reuben et al. 2014).

H1: Patent applications filed by female inventors receive less favorable patent examination outcomes.

Hypothesis Development (II)

- Taste-based or statistical discrimination?
  - Theories of statistical discrimination: stereotypes or biased beliefs emerge when information about an individual's traits is limited, causing people to rely on statistical information of broader group to infer individual quality (Arrow, 1998; Phelps, 1972).
  - People often amplify minor differences between groups or make judgments based on how strongly a group is represented in an activity or a profession (Bordalo et al., 2016; 2019).
  - Bohren et al. (2019): In dynamic environments where individuals repeatedly execute tasks, discriminatory tendencies towards women diminish as prior evaluations are available.
  - Hebert (2023) finds that VC funding is more readily available to entrepreneurs in more typically-female fields.
- **H1A: The gender gap in patenting outcomes decline when inventors can better signal their abilities or in technological areas where women are more strongly represented (less male-dominant).**

Main Findings

- Patent applications authored by women are significantly less likely than those authored by men to receive a first-action approval or ultimate granting.
- The gender disparity is partly due to gender bias:
  - The female disadvantage is attenuated when applications are filed by those with rare first names – a gender-blind sample.
  - Granted patents by women are associated with significantly higher economic value compared to their male-authored counterparts.
- Consistent with the effects of statistical discrimination, gender gap in approval rates is smaller for experienced inventors and in technological art units with higher female representation.

Data

- Patent data
  - Patent Examination Research Dataset (PatEx): detailed information on U.S. patent applications and grants, along with their entire examination histories (2001-2020)
  - USPTO PatentsView database: assignee information, inventor name and location, technological classifications, and citations

- Identify inventor gender: U.S. Social Security application record & genderize.io
  - Code an inventor as female (male) only if their first name is used by a woman (man) more than 95% of the time
  - Able to infer gender for about 90% of our sample inventors
  - Exclude patent applications where at least one inventor's gender cannot be identified (80% applications remaining)
  - Final sample consists of 988,125 U.S. utility patent applications filed from 2001 to 2017

Empirical Setup

- Regression model:

$$Application\ Outcome_{i,j,k,t} = \beta_0 + \beta_1 Female\ Inventor_{i,t} + \lambda Application\ Characteristics_{i,t}$$

$$+\phi Examiner\ Characteristics_{j,t} + ArtUnit \times Subclass \times Year_{k,t} + \epsilon_{i,t} \quad (1)$$

- Female inventor measures:
  1) *Fraction Female:* proportion of female inventors listed on a patent application
  2) *Majority Female:* a dummy variable equal to one if at least 50% of the inventor team are females and zero otherwise
  3) *All Female:* a dummy variable equal to one if the entire inventor team consists only of females and zero otherwise
  4) *All Female (Unisex Team):* a dummy variable equal to one for all-female inventor teams and zero for all-male inventor teams
  5) *Solo Female (Solo Team):* a dummy variable equal to one if there is a single female inventor and zero if there is a single male inventor

Summary Statistics

	N	Mean	Median	SD
First-Action Allowance	988,125	0.075	0	0.264
Patent Granted	988,125	0.685	1	0.464
Fraction Female	988,125	0.081	0	0.214
Majority Female	988,125	0.040	0	0.195
All Female	988,125	0.031	0	0.173
All Female (Unisex Team)	853,233	0.036	0	0.186
Solo Female (Solo Team)	374,847	0.069	0	0.254
Have at Least One Female Inventor	988,125	0.167	0	0.373
Examiner Review Speed	988,125	1.729	2	0.756
Examiner Leniency	988,125	0.642	0.676	0.207
Examiner Experience	988,125	12.121	10	7.891
Small Entity	988,125	0.326	0	0.469
Foreign Priority	988,125	0.004	0	0.061
Continuation	988,125	0.645	1	0.479
Number of Inventors	988,125	2.353	2	1.603
Solo Inventor	988,125	0.379	0	0.485
Initial Num. of Claims	988,125	3.593	3	4.570
Inventor Experience	988,125	21.510	6	58.640
Experienced Inventor Team	988,125	0.737	1	0.440
Art Unit (More Female Shares)	988,125	0.496	0	0.500

OLS Regression (Dependent Var = First-Action Allowance)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Female Inventor	-0.004***	-0.005***	-0.005***	-0.005***	-0.006***
	(0.005)	(0.000)	(0.001)	(0.003)	(0.003)
Examiner Review Speed	-0.005***	-0.005***	-0.005***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Examiner Leniency	0.142***	0.142***	0.142***	0.147***	0.135***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(1+Examiner Experience)	0.025***	0.025***	0.025***	0.026***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Small Entity	-0.009***	-0.009***	-0.009***	-0.009***	-0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Foreign Priority	-0.003	-0.003	-0.003	0.001	0.005
	(0.513)	(0.514)	(0.514)	(0.793)	(0.568)
Continuation	0.012***	0.012***	0.012***	0.011***	0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of Inventors	-0.001***	-0.001***	-0.001***	-0.001***	
	(0.001)	(0.000)	(0.000)	(0.001)	
Solo Inventor	-0.001	-0.000	-0.000	-0.001	
	(0.435)	(0.637)	(0.666)	(0.218)	
Initial Num. of Claims	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Inventor Experience	0.000***	0.000***	0.000***	0.000**	-0.000
	(0.001)	(0.001)	(0.001)	(0.019)	(0.756)
Constant	-0.066***	-0.066***	-0.066***	-0.068***	-0.055***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.126	0.126	0.126	0.123	0.137

6.7% decline relative to the 7.5% first-action approval rate

OLS Regression (Dependent Var = Patent Granted)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Female Inventor	-0.053***	-0.049***	-0.054***	-0.054***	-0.049***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Examiner Review Speed	-0.023***	-0.023***	-0.023***	-0.023***	-0.028***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Examiner Leniency	0.660***	0.660***	0.660***	0.656***	0.670***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(1+Examiner Experience)	0.013***	0.013***	0.013***	0.013***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Small Entity	-0.162***	-0.162***	-0.162***	-0.168***	-0.178***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Foreign Priority	-0.042***	-0.042***	-0.042***	-0.043***	-0.039***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)
Continuation	0.010***	0.011***	0.011***	0.010***	0.026***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of Inventors	0.005***	0.004***	0.004***	0.005***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Solo Inventor	-0.032***	-0.029***	-0.028***	-0.029***	
	(0.000)	(0.000)	(0.000)	(0.000)	
Initial Num. of Claims	0.001***	0.001***	0.001***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)
Inventor Experience	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)
Constant	0.316***	0.313***	0.313***	0.319***	0.268***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.257	0.257	0.257	0.260	0.279

7.9% decline compared to the 68.5% unconditional patent grant rate

Is Gender Gap in Patenting Driven by Patent Quality Difference?

- Compare results between subsamples of applications whose inventors have commonly or rarely used first names.
  - If results are driven by gender bias, the gender disparities in first-action approval and grant rates will diminish among applications with rare names (gender-blind sample).
  - If patenting differences stem from across-gender differences in patent quality, the female inventor disadvantage will remain similarlty among applications with rare and common names.
  - Rare (common) first names are those with frequency counts in the bottom (top) 10 percentile or 1 percentile among all names in the Social Security Application database.

Rare names: 'Irshad' vs. 'Manijeh'

The Solo Inventor Sample by Rare vs. Common Names

	Common Names N=247,619		Rare Names N=21,960	
	Mean	Median	Mean	Median
First-Action Allowance	0.073	0	0.075	0
Patent Granted	0.622	1	0.618	1
Citations	10.755	3	9.586	3
Solo Female	0.068	0	0.085	0
Examiner Review Speed	1.686	2	1.767	2
Examiner Leniency	0.628	0.659	0.635	0.670
Examiner Experience	12.234	10	11.718	10
Small Entity	0.469	0	0.396	0
Foreign Priority	0.005	0	0.016	0
Continuation	0.627	1	0.598	1
Initial Num. of Claims	3.340	3	3.490	3
Inventor Experience	13.096	2	12.390	1
Experienced Inventor Team	0.575	1	0.533	1

Rare versus Common Inventor Names

	Rare (Common) name in bottom (top) 10%		Rare (Common) name in bottom (top) 1%	
Dependent Variable	First-Action Allowance	Patent Granted	First-Action Allowance	Patent Granted
	(1)	(2)	(3)	(4)
Solo Female (β_1)	-0.008***	-0.053***	-0.008***	-0.054***
	(0.001)	(0.000)	(0.001)	(0.000)
Solo Female × Rare Name (β_2)	0.014*	0.028**	0.017**	0.030**
	(0.078)	(0.050)	(0.042)	(0.041)
Rare Name (β_3)	-0.002	-0.022***	-0.002	-0.022***
	(0.452)	(0.000)	(0.371)	(0.000)
Controls	Yes	Yes	Yes	Yes
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes
Test: $\beta_1+\beta_2=0$	0.006	-0.025*	0.009	-0.024*
p-value	(0.415)	(0.061)	(0.260)	(0.081)
N	269,579	269,579	252,515	252,515
adj. R-sq	0.139	0.28	0.141	0.282

Gap in gender-blind sample

- Sample: Solo-inventor applications with rare or common first names
- Rare Name: A dummy for inventors with rare first names (those with frequency counts in the bottom 10 percentile or 1 percentile among all names in the Social Security Application database).

Inventor Gender and Patent Value

Dependent Variable:	Patent Value ($ Millions)				
Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Female Inventor	1.103***	0.978**	0.687	0.788*	0.611
	(0.009)	(0.025)	(0.122)	(0.087)	(0.215)
Control Variables	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
N	404,551	404,551	404,551	343,930	112,097
adj. R-sq	0.624	0.624	0.624	0.621	0.620

Patent Value: the economic value of each patent based on the stock return of patent grant announcement (KPSS, 2017).
Control variables: *LN_Asset, ROA, R&D/Asset, CAPEXTA, Leverage, Market-to-book, Institutional Holding%, Ln(Age), PPE/Asset, HHI, HHI^2, KZ-INDEX*

Inventor Gender and Patent Value: Rare vs. Common Names

Dependent Variable:	Patent Values ($ Millions)	
	Rare (Common) name in bottom (top) 10%	Rare (Common) name in bottom (top) 1%
	(1)	(2)
Solo Female (β_1)	1.441**	1.243**
	(0.020)	(0.043)
Solo Female × Rare Name (β_2)	-2.437**	-2.255**
	(0.023)	(0.026)
Rare Name (β_3)	-0.568*	-0.607*
	(0.078)	(0.063)
Controls	Yes	Yes
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Test: $\beta_1 + \beta_2 = 0$	-0.996	-1.008
p-value	(0.270)	(0.259)
N	102,496	97,090

Gender gap in gender-blind sample

Inventor Gender and Total Forward Citation

Dependent Variable:	Ln(1 + Citations)				
Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Female Inventor	-0.140***	-0.086***	-0.069***	-0.081***	-0.075***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control Variables	Yes	Yes	Yes	Yes	Yes
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
N	627,195	627,195	627,195	527,226	159,537
adj. R-sq	0.377	0.377	0.377	0.379	0.385

Hochberg et al. (2023): Patents authored by female inventors are significantly ‘under-cited’ compared to otherwise similar patents authored by men.

Inventor Gender and Citations Counts by Gender of Citing Inventor

Dependent Variable:	Ln(1 + Female (or Male) Citations)									
Female Inventor:	Fraction Female		Majority Female		All Female		All Female (Unisex Teams)		Solo Female (Solo Teams)	
Citations:	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female Inventor	0.278***	-0.364***	0.164***	-0.231***	0.162***	-0.214***	0.176***	-0.236***	0.182***	-0.204***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control Vars.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Art Unit Subclass x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	438,906	438,906	438,906	438,906	438,906	438,906	371,691	371,691	108,798	108,798
adj. R-sq	0.272	0.360	0.269	0.358	0.269	0.357	0.268	0.356	0.263	0.361

Inventor Gender and Forward Citation: Rare vs. Common Names

Dependent Variable:	Ln(1 + Citations)	
	Rare (Common) name in bottom (top) 10%	Rare (Common) name in bottom (top) 1%
	(1)	(2)
Solo Female (β_1)	-0.095***	-0.100***
	(0.000)	(0.000)
Solo Female × Rare Name (β_2)	0.227***	0.236***
	(0.000)	(0.000)
Rare Name (β_3)	-0.012	-0.010
	(0.408)	(0.508)
Controls	Yes	Yes
Art Unit Subclass × Year FEs	Yes	Yes
Test: $\beta_1 + \beta_2 = 0$	0.132***	0.136***
p-value	(0.008)	(0.007)
N	144,471	135,014
adj. R-sq	0.391	0.393

Conditional on Experienced Inventor Team (First-Action Approval)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Panel A: Dept. Var=First-Action Allowance					
Female Inventor (β1)	-0.005***	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.008)
Female Inventor × Experienced Inventor Team (β2)	0.005**	0.004	0.007**	0.009**	0.006
	(0.026)	(0.108)	(0.034)	(0.011)	(0.180)
Experienced Inventor Team (β3)	0.007***	0.007***	0.007***	0.007***	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Test: β1+ β2=0	0.000	-0.001	0.001	0.002	0.000
p-value	(0.905)	(0.529)	(0.745)	(0.435)	(0.999)
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.126	0.126	0.126	0.123	0.137

Gender gap among experienced inventors

Experienced Inventor Team = 1 if at least one inventor on the team has previously filed a patent application, and zero otherwise.

Conditional on Experienced Inventor Team (Patent Granted)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Panel B: Dept. Var=Patent Granted					
Female Inventor (β1)	-0.054***	-0.055***	-0.060***	-0.059***	-0.048***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female Inventor × Experienced Inventor Team (β2)	0.019***	0.033***	0.044***	0.043***	0.036***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Experienced Inventor Team (β3)	0.041***	0.042***	0.042***	0.043***	0.054***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Test: β1+ β2=0	-0.035***	-0.022***	-0.016***	-0.016***	-0.012*
p-value	(0.000)	(0.000)	(0.002)	(0.003)	(0.090)
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.258	0.258	0.258	0.262	0.282

Experienced Inventor Team = 1 if at least one inventor on the team has previously filed a patent application, and zero otherwise.

Conditional on Female Inventor Representation in Art Units

Panel A. Summary Statistics on Female Inventor Share

	Mean	Median	Max	Min
Female Inventor Share	8.7%	7.2%	28.2%	1.3%

Panel B. List of Art Units with Top Three and Bottom Three Female Inventor Shares

	Art Unit Code	Art Unit Name	*Female Inventor Share*
Top 3	1676	Process, Nucleic acid, Protein, Carbohydrate Chemistries and Diagnostics	28.2%
	1646	Cytokines Recombinant Hormones, Body treating compositions	27.6%
	1647	Immunology, Receptor/Ligands	27.3%
Bottom 3	3655	Planetary gear transmission systems or components	1.3%
	3672	Wells	1.9%
	3657	Brakes	2.0%

Conditional on Female Representation (First-Action Approval)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent Variable = First-Action Allowance					
Female Inventor (β1)	-0.008**	-0.012***	-0.010***	-0.010***	-0.010**
	(0.013)	(0.001)	(0.005)	(0.006)	(0.041)
Female Inventor × Art Unit (More Female Shares) (β2)	0.005*	0.009**	0.007*	0.008*	0.005
	(0.100)	(0.015)	(0.076)	(0.065)	(0.342)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Test: β1+ β2=0	-0.002	-0.003*	-0.003**	-0.003*	-0.005**
p-value	(0.122)	(0.053)	(0.048)	(0.096)	(0.032)
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.126	0.126	0.126	0.123	0.137

Gender gap in art units with more female inventors

Art Unit (More Female Shares)= 1 if if the percentage of female inventors on patent applications in an art unit during the past three years is above the sample median.

Conditional on Female Representation (Patent Granted)

Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Panel B: Dependent Variable = Patent Granted					
Female Inventor (β1)	-0.058***	-0.060***	-0.065***	-0.065***	-0.057***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female Inventor × Art Unit (More Female Shares) (β2)	0.008	0.015**	0.015**	0.015*	0.011
	(0.160)	(0.031)	(0.044)	(0.060)	(0.244)
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Test: β1+ β2=0	-0.050***	-0.045***	-0.050***	-0.050***	-0.046***
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	988,125	988,125	988,125	829,781	295,600
adj. R-sq	0.257	0.257	0.257	0.260	0.279

Art Unit (More Female Shares)= 1 if if the percentage of female inventors on patent applications in an art unit during the past three years is above the sample median.

Persistence in Patent Examination Process

		All Applications	All-Female Teams	All-Male Teams
First round	Number of Applications	988,125	30,576	822,657
	Accepted (first-action allowance)	0.075	0.045	0.079
	Rejected	0.925	0.955	0.921
	Abandoned	0.152	0.255	0.149
	Amended/Appealed	0.848	0.745	0.851
Second round	Number of Applications	769,385	21,599	640,437
	Accepted	0.760	0.608	0.765
	Rejected	0.240	0.392	0.235
	Abandoned	0.387	0.552	0.376
	Amended/Appealed	0.613	0.448	0.624
All rounds	Accepted	0.685	0.489	0.697
	Rejected	0.315	0.511	0.303

Inventors Gender and Filing an Initial Amendment (OLS)

Dependent Variable:	*Initial Amendment*				
Female Inventor:	Fraction Female	Majority Female	All Female	All Female (Unisex Teams)	Solo Female (Solo Teams)
	(1)	(2)	(3)	(4)	(5)
Female Inventor	-0.023***	-0.021***	-0.026***	-0.026***	-0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control Variables	Yes	Yes	Yes	Yes	Yes
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes	Yes
N	888,786	888,786	888,786	743,048	263,857
adj. R-sq	0.114	0.114	0.114	0.118	0.120

Conclusion

- We documents inventor gender disparities in patent examination process, offering evidence of two primary reasons contributing to this divide:
  - gender bias toward female inventors stemming from statistical discrimination due to limited information;
  - lower persistence among female inventors when amending their applications.
- Our study offers policy implications to foster a more equitable landscape in intellectual property rights:
  - advocate for a 'gender blind' examination process;
  - emphasize the importance of offering guidance and support throughout the filing and amendment processes.
- A shift in attitudes toward women in STEM fields has a potential to increase value not only for inventors and firms but also for society as a whole.

Thank you!

Different from Aneja et al. (2024)

- Aneja et al. (2024) find no gender effects at the first-action stage and conclude that examiner bias is not a significant factor in the patenting process.
  We replicate their results and find that the discrepancy arises from their sample selection procedure, which results in non-utility patents being included in their sample. These non-utility patents have substantially lower initial rejection rates (0.147 compared to 0.891 for utility patents) and are more frequently associated with female inventors. We find that excluding these non-utility patents from their sample yields similar results to those reported in Panel A of Table 2.

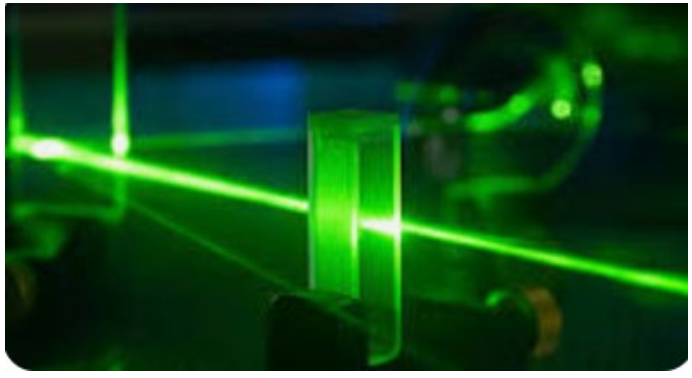
Two Sources of the Gender Gap

	Rare (Common) name in bottom (top) 10%		Rare (Common) name in bottom (top) 1%	
Dependent Variable	First-Action Allowance	Patent Granted	First-Action Allowance	Patent Granted
	(1)	(2)	(3)	(4)
Solo Female (β_1)	-0.008***	-0.053***	-0.008***	-0.054***
	(0.001)	(0.000)	(0.001)	(0.000)
Solo Female × Rare Name (β_2)	0.014*	0.028**	0.017**	0.030**
	(0.078)	(0.050)	(0.042)	(0.041)
Rare Name (β_3)	-0.002	-0.022***	-0.002	-0.022***
	(0.452)	(0.000)	(0.371)	(0.000)
Controls	Yes	Yes	Yes	Yes
Art Unit Subclass × Year FEs	Yes	Yes	Yes	Yes
Test: $\beta_1 + \beta_2 = 0$	0.006	-0.025*	0.009	-0.024*
p-value	(0.415)	(0.061)	(0.260)	(0.081)
N	269,579	269,579	252,515	252,515
adj. R-sq	0.139	0.28	0.141	0.282

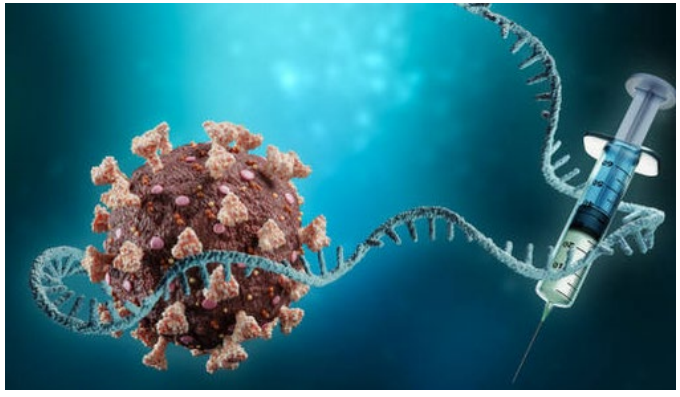
3% (= 5.4% - 2.4%) due to examiner gender bias;
2.4% due to 'persistence gap'

Woman Inventors

Josephine Cochran



Ursula Keller



Katalin Kariko