# Women in economics: the role of gendered advising practices at entry in the profession

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*The views and opinions expressed in this presentation are those of the authors and do not necessarily reflect the those of the Bank of Italy or Bocconi University.*

# Introduction

Under-representation of women in economics profession

- "likely hampers the discipline, constraining the range of issues addressed and limiting the ability to understand familiar issues from new and innovative perspectives" (Bayer and Rouse, 2016)

However:

- It is a widespread phenomenon
- Especially in some fields
- Especially at higher positions, *"leaky pipeline"*
- Progress has been stalling in recent years

# This paper

What:

- Focus on transition from graduate program to work
- Analyze gender differences in advisors' support and referrals (language as a proxy for stereotypes)
- Explore their influence on (early) career outcomes

How:

1. Build novel dataset on large sample of job market candidates and letter writers
2. Study content and style of reference letters to unveil gender stereotypes
3. Track candidates to their career outcomes and study relation with (2)

# Related literature

1. Econ literature on roots of leaky pipeline in the profession:

   - Differences in observables, e.g., student-advisor matching (Hilmer and Hilmer, 2007); field of specialization (Fortin et al., 2021; Oaxaca and Sierminska, 2021)

   - Implicit gender bias and stereotypes, e.g., students (Paredes et al., 2020), faculty (Jansson and Tyrefors, 2020), publication process (Sarsons, 2017; Sarsons et al., 2021; Hengel, 2017) citation patterns (Koffi, 2021a,b) seminars behavior (Dupas et al., 2021)

2. Psychology and linguistics on implicit gender bias in reference process:

   - Applied psychology: letters for female candidates put more emphasis on inter-personal skills and personality characteristics and less emphasis on ability (Schmader et al., 2007; Madera et al., 2009; Chapman et al., 2020)

# Data and descriptives

# Data

- Build a novel dataset containing all job market application packages to three departments at two top institutions hiring in the international job market: 10 (5) years of data, $N_C \approx 8,000$ ($\approx$ 800 candidates applied to more than one)
- Classify candidates and referees by gender using names libraries
- Retrieve info on pre-job market career from CVs
- Collect all reference letters, $N_L \approx 25,000$
- Collect info on career outcomes by scraping of Linkedin, Google Scholar and Repec, track about 94% of candidates
- Match academic institutions (of origin and destination) with QS ranking and Repec ranking

# Descriptives

Figure: Gender composition of applicants and letter-writers by year of application.




- Female candidates and academics are a minority
- No improvement over last decade

# Candidate descriptives: pre job market

| | N | Male | Female | Difference |
|---|---|---|---|---|
| **Pre-JM:** | | | | |
| American/Canadian PhD | 7077 | 0.532 | 0.484 | 0.048*** |
| EU PhD | 7077 | 0.433 | 0.476 | -0.044*** |
| Italian PhD | 7077 | 0.066 | 0.100 | -0.033*** |
| Applied micro | 7077 | 0.245 | 0.345 | -0.100*** |
| Macro/International/Finance | 7077 | 0.444 | 0.395 | 0.048*** |
| Theory/Quantitative | 7077 | 0.242 | 0.197 | 0.044*** |
| Top-20 QS | 7063 | 0.171 | 0.151 | 0.020** |
| Top-20 Repec Econ | 7063 | 0.267 | 0.214 | 0.052*** |
| Phd ranking Repec Econ | 7063 | 108.031 | 112.837 | -4.806 |
| # Publications pre-JM | 7077 | 0.717 | 0.531 | 0.186*** |

*Notes*: * denotes significance at 10%, ** significance at 5% and *** significance at 1%.

- Female candidates more likely to have EU Phds, come from lower ranked institutions, and have fewer pre-JM publications
- Significant gender differences in fields of research
- A representative sample of the (European) job market

# Candidate descriptives: job market and career

| | N | Male | Female | Difference |
|---|---|---|---|---|
| **References:** | | | | |
| # Letter writers | 7077 | 3.249 | 3.211 | 0.038* |
| # Uploaded letters | 7077 | 2.705 | 2.625 | 0.079** |
| # Female letter writers | 7077 | 0.391 | 0.582 | -0.190*** |
| Main advisor female | 7077 | 0.110 | 0.166 | -0.055*** |
| Average letter length | 6028 | 1029.744 | 992.534 | 37.210*** |
| **Post-JM:** | | | | |
| Academic placement (Linkedin) | 6641 | 0.754 | 0.747 | 0.007 |
| Placement Top 20 QS (general) | 6641 | 0.066 | 0.072 | -0.006 |
| Placement Top 20 Repec Econ | 6641 | 0.075 | 0.081 | -0.006 |
| Associate professor | 6641 | 0.168 | 0.118 | 0.050*** |
| Assistant professor | 6641 | 0.464 | 0.500 | -0.036*** |
| PostDoc | 6641 | 0.120 | 0.133 | -0.014 |
| # Publications | 7077 | 2.374 | 1.535 | 0.838*** |
| Top 5 econ or Top 3 fin publication | 7077 | 0.085 | 0.055 | 0.030*** |
| # Citations (Repec) | 7077 | 41.068 | 26.184 | 14.884*** |

- Evidence of weaker support on the job market
- Worse career outcomes as for position and publication records

# Letter writers descriptives

| | N | Male | Female | Difference |
|---|---|---|---|---|
| Gender of referee | 8464 | 7,015 | 1,449 | |
| # letters written | 8464 | 2.659 | 1.989 | 0.670*** |
| At least 1 female advisee | 7238 | 0.452 | 0.517 | -0.065*** |
| Av. letter length (words) | 7238 | 931.200 | 941.480 | -10.281 |
| First publication year | 6683 | 1993.995 | 1997.974 | -3.979*** |
| Full professor | 8464 | 0.240 | 0.186 | 0.055*** |
| Academic affiliation | 8464 | 0.777 | 0.743 | 0.034*** |
| # articles Repec | 8464 | 19.899 | 11.333 | 8.567*** |
| # publications GS | 8464 | 70.797 | 46.529 | 24.268*** |
| # Top 5 publications | 7860 | 2.236 | 1.113 | 1.124*** |
| At least 1 Top 5 publication | 7860 | 0.424 | 0.342 | 0.082*** |
| # citations | 8464 | 1006.266 | 533.296 | 472.970*** |

*Notes*: * denotes significance at 10%, ** significance at 5% and *** significance at 1%.

- Female referees write fewer but longer letters, more often for female students; less experienced and with lower academic achievement

# Text Analysis of reference letters

# Corpus construction and pre-processing

- Exclude letters in Italian and drop duplicates ($\approx 4,000$)
- Anonymize texts
- Pre-processing: split contractions, remove double spaces, punctuation, emails, links, numbers and stopwords
- *Tokenize* text, i.e. transform into a list of words
- *Lemmatize* text, i.e. substitute words with their dictionary base form



- 18,925 documents ($D$), 82,648 unique lemmas ($V$)
- Each document is a vector of frequencies of words in $V$

# Corpus description

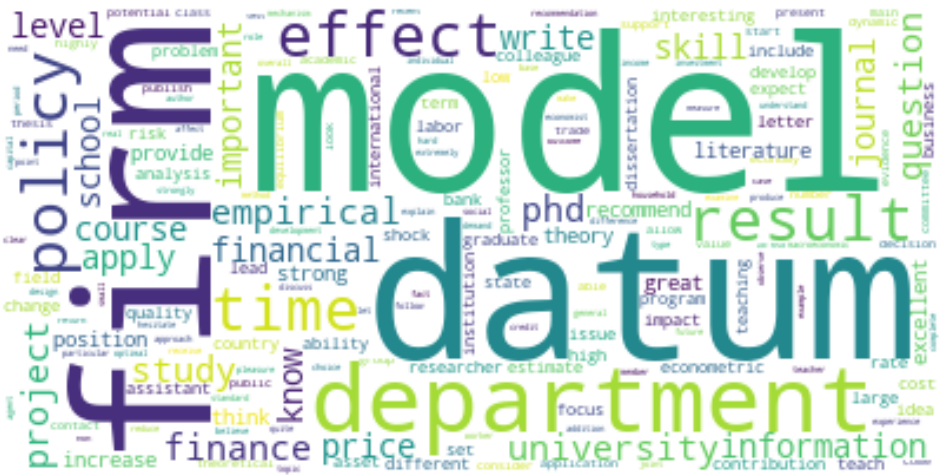
- Consider corpus just as a *bag of (lemmatized) words*
- Can show content of documents as set of *most frequent* words
- or give more weight to words that most characterize each document:

$$tfidf_v = (1 + log(tf_v)) \times (1 + log \frac{N}{df_v})$$

Figure: Raw frequencies




Figure: Weighted frequencies (*tfidf*)



# Supervised analysis: word embeddings

- But what do sponsors say about candidates?
- We resort to a supervised approach
- We start from the semantic categories identified in Schmader et al. (2007); Madera et al. (2009); Chapman et al. (2020):

**Standout**

excellent, outstanding, unique, exceptional, best, wonderful, extraordinary...

**Grindstone**

hardworking, conscientious, meticulous, thorough, effort, diligent, careful, dedicated...

**Communal**

agreeable, quite, considerate, helpful, friendly, interpersonal, warm, pleasant, humble...

**Agentic**

assertive, confident, independent, ambitious, successful, tenacious...

# Supervised analysis: word embeddings

*"You shall know a word by the company it keeps" (Firth, 1957)*

- Each target word is transformed in a low dimensional object (vector) whose position and relative proximity to other words/vectors captures their semantic similarity
- Similarity is defined through cosine distance: word vectors with smaller angles are more similar

$$\begin{aligned} \text{Cosine similarity} = -1 &\rightarrow \text{opposite vectors;} \\ 0 &\rightarrow \text{unrelated vectors;} \\ 1 &\rightarrow \text{same vector} \end{aligned}$$

# Results: cosine similarities

Table: Cosine similarity between reference to candidate and target average vectors, by candidate's gender

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Cosine Similarity | | | Difference | Cond. Diff. |
| | Obs | Male | Female | (2)-(3) | (2)-(3) |
| Standout | 6004 | 0.245 | 0.240 | 0.005*** | 0.006*** |
| Grindstone | 6004 | 0.216 | 0.224 | -0.008*** | -0.006*** |
| Communal | 6004 | 0.217 | 0.219 | -0.002 | 0.002 |
| Agentic | 6004 | 0.236 | 0.242 | -0.005*** | 0.002 |

- Female candidates are described more in terms of grindstone (and agentic), and less in terms of standout words

# Results by gender of letter writer

Table: Cosine similarity between reference to candidate and target average vectors, by referee's gender

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | Cosine Similarity | | Difference |
| | Obs | Male referee | Female referee | (2)-(3) |
| Standout | 7097 | 0.237 | 0.237 | 0.001 |
| Grindstone | 7097 | 0.195 | 0.210 | -0.016*** |
| Communal | 7097 | 0.189 | 0.195 | -0.006*** |
| Agentic | 7097 | 0.213 | 0.225 | -0.012*** |

- Female letter writers tend to emphasize candidate personal traits more compared to male letter writers

# Results by gender of letter writer and of candidate

Table: Cosine similarity between reference to candidate and target average vectors, by candidate and referee gender

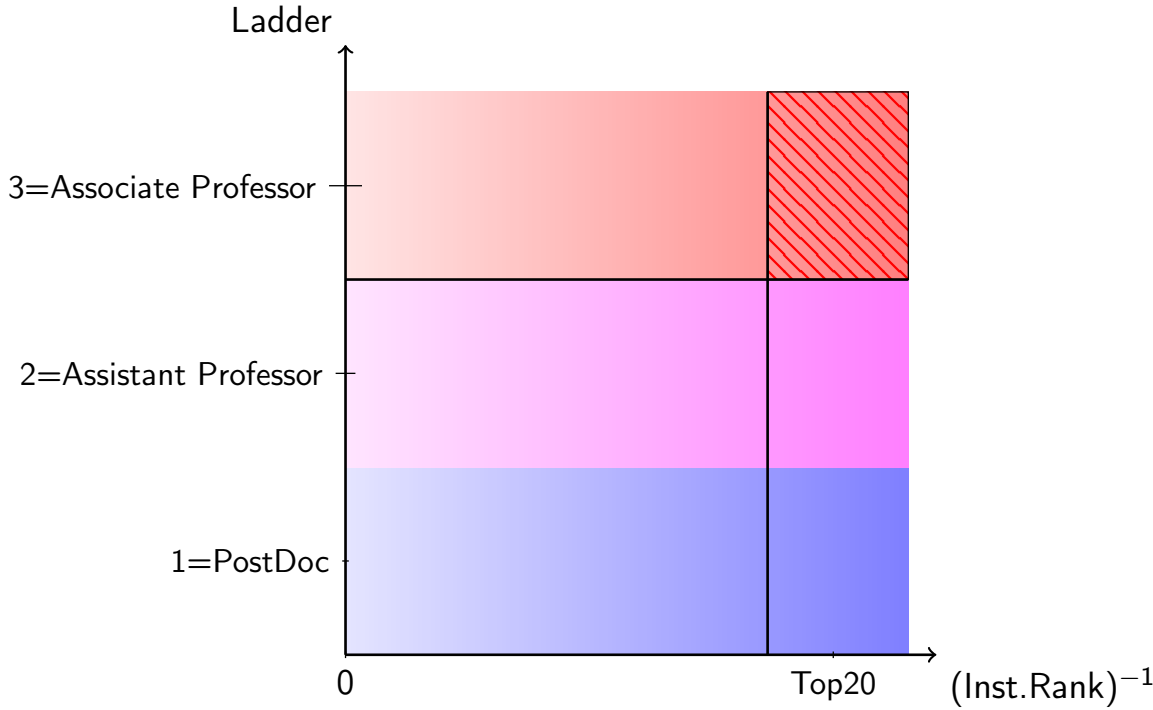
| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | Cosine Similarity: | | Difference |
| | Obs | Male cand. | Female cand. | (2)-(3) |
| A. Only male referees | | | | |
| Standout | 7,613 | 0.231 | 0.227 | 0.004** |
| Grindstone | 7,613 | 0.193 | 0.200 | -0.007*** |
| Communal | 7,613 | 0.188 | 0.185 | 0.003* |
| Agentic | 7,613 | 0.210 | 0.213 | -0.002 |
| B. Only female referees | | | | |
| Standout | 1,459 | 0.225 | 0.226 | -0.001 |
| Grindstone | 1,459 | 0.210 | 0.215 | -0.005 |
| Communal | 1,459 | 0.196 | 0.192 | 0.004 |
| Agentic | 1,459 | 0.223 | 0.223 | -0.000 |

- Gendered language only in letters written by male advisors; female advisors are instead gender-neutral

# Effects on career outcomes

# Empirical strategy

- How to define a measure of success?
- $y \equiv \mathbb{1}$(Top20 & Associate prof.)




$$y_i = \alpha + \beta_1 Female_i + \beta_2 Candidate_X_i + \beta_3 LetterWriter_X_i + \\ + \beta_4 Letters_X_i + \beta_5 WE_i + \varepsilon_i$$

# Career success: 𝟙(Top20 & Associate prof.)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Female | -0.00921*** | -0.00906*** | -0.00683** | -0.00753** | -0.00781** | -0.00829** | -0.00563 |
| | (0.00309) | (0.00343) | (0.00345) | (0.00341) | (0.00343) | (0.00342) | (0.00342) |
| # Publications Pre-JM | | | 0.00210** | | | | 0.00192** |
| | | | (0.000982) | | | | (0.000978) |
| Main lett. writer female | | | | 0.00193 | | | 0.00136 |
| | | | | (0.00484) | | | (0.00477) |
| # Top 5 public. (main lett. writer) | | | | 0.00150*** | | | 0.00100** |
| | | | | (0.000378) | | | (0.000422) |
| Full professor (main lett. writer) | | | | 0.00768* | | | 0.00800** |
| | | | | (0.00395) | | | (0.00404) |
| # Letter writers | | | | | 0.00992*** | | 0.00780*** |
| | | | | | (0.00282) | | (0.00283) |
| Average letter length (std) | | | | | 0.0118*** | | 0.00939*** |
| | | | | | (0.00217) | | (0.00235) |
| Standout cos. sim. | | | | | | 0.0574* | 0.0367 |
| | | | | | | (0.0295) | (0.0302) |
| Grindstone cos. sim. | | | | | | -0.0519* | 0.00238 |
| | | | | | | (0.0286) | (0.0317) |
| Mean dependent variable men | 0.017 | 0.017 | | | | | |
| % Raw Gap Explained | | | 24.6 | 16.9 | 13.8 | 8.5 | 37.9 |
| Raw | ✓ | ✓ | | | | | |
| Candidate chars | | | ✓ | | | | ✓ |
| Letter writer chars | | | | ✓ | | | ✓ |
| Letter chars | | | | | ✓ | | ✓ |
| WEs | | | | | | ✓ | ✓ |
| $R^2$ | 0.0106 | 0.0113 | 0.0264 | 0.0221 | 0.0208 | 0.0123 | 0.0372 |
| N | 6511 | 5699 | 5699 | 5699 | 5699 | 5699 | 5699 |

**Notes:** Robust Standard errors in parentheses. * $p < 0.1$, ** $p < .05$, *** $p < 0.01$

# Research productivity: 𝟙(Top 8 publications)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Female | -0.0272*** | -0.0276*** | -0.0208*** | -0.0240*** | -0.0243*** | -0.0256*** | -0.0174** |
| | (0.00647) | (0.00730) | (0.00720) | (0.00730) | (0.00725) | (0.00734) | (0.00719) |
| # Publications Pre-JM | | | 0.0285*** | | | | 0.0282*** |
| | | | (0.00324) | | | | (0.00324) |
| Main lett. writer female | | | | 0.00812 | | | 0.00254 |
| | | | | (0.0103) | | | (0.0100) |
| # Top 5 public. (main lett. writer) | | | | 0.00392*** | | | 0.00275*** |
| | | | | (0.000583) | | | (0.000617) |
| Full professor (main lett. writer) | | | | 0.00551 | | | 0.00704 |
| | | | | (0.00752) | | | (0.00735) |
| # Letter writers | | | | | 0.0213*** | | 0.0147** |
| | | | | | (0.00609) | | (0.00579) |
| Average letter length (std) | | | | | 0.0313*** | | 0.0280*** |
| | | | | | (0.00369) | | (0.00385) |
| Standout cos. sim. | | | | | | 0.190*** | 0.127** |
| | | | | | | (0.0551) | (0.0541) |
| Grindstone cos. sim. | | | | | | -0.106* | 0.0558 |
| | | | | | | (0.0578) | (0.0590) |
| Mean dependent variable men | 0.077 | 0.075 | | | | | |
| % Raw gender gap explained | | | 24.6 | 13.0 | 12.0 | 7.2 | 37.0 |
| Raw | ✓ | ✓ | | | | | |
| Candidate chars | | | ✓ | | | | ✓ |
| Letter writer chars | | | | ✓ | | | ✓ |
| Letter chars | | | | | ✓ | | ✓ |
| WEs | | | | | | ✓ | ✓ |
| $R^2$ | 0.0283 | 0.0350 | 0.101 | 0.0510 | 0.0498 | 0.0371 | 0.119 |
| N | 6913 | 5699 | 5699 | 5699 | 5699 | 5699 | 5699 |

**Notes:** Robust Standard errors in parentheses. * $p < 0.1$, ** $p < .05$, *** $p < 0.01$

# Conclusions

- The job market is a key step in the academic career
- Referral process is not gender neutral
- Female candidates receive different support relative to males, quantitatively (fewer letters) and qualitatively (more emphasis on personality rather than professional traits)
- Use of gendered language mainly driven by male letter writers
- Accounting for such differences reduces the observed gender gaps in early career outcomes
- Policy implications? Whether and how to use referrals for hiring and promotions, especially in highly male-dominated work environments

# References I


Bayer, A. and Rouse, C. E. (2016). Diversity in the economics profession: A new attack on an old problem. *Journal of Economic Perspectives*, 30(4):221–42.

Chapman, B., Rooney, M., Ludmir, E., Cruz, D., Salcedo, A., Pinnix, C., Das, P., Jagsi, R., Thomas, C., and Holliday, E. (2020). Linguistic biases in letters of recommendation for radiation oncology residency applicants from 2015 to 2019. *Journal of Cancer Education*.

Dupas, P., Modestino, A. S., Niederle, M., Wolfers, J., and Collective, T. S. D. (2021). Gender and the Dynamics of Economics Seminars. NBER Working Papers 28494, National Bureau of Economic Research, Inc.

Firth, J. R. (1957). A synopsis of linguistic theory 1930-55. *Studies in Linguistic Analysis (special volume of the Philological Society)*, 1952-59:1–32.

Fortin, N., Lemieux, T., and Rehavi, M. (2021). Gender differences in fields of specialization and placement outcomes among phds in economics. *AEA Papers and Proceedings*, 111:74–79.

Hengel, E. (2017). Publishing while Female. Are women held to higher standards? Evidence from peer review. Cambridge Working Papers in Economics 1753, Faculty of Economics, University of Cambridge.

Hilmer, C. and Hilmer, M. (2007). Women helping women, men helping women? same-gender mentoring, initial job placements, and early career publishing success for economics phds. *American Economic Review*, 97(2):422–426.

# References II


Jansson, J. and Tyrefors, B. (2020). The Genius is a Male: Stereotypes and Same-Sex Bias in Exam Grading in Economics at Stockholm University. Working Paper Series 1362, Research Institute of Industrial Economics.

Koffi, M. (2021a). Gendered citations at top economic journals. *AEA Papers and Proceedings*, 111:60–64.

Koffi, M. (2021b). Innovative ideas and gender inequality. Technical report.

Madera, J. M., Hebl, M. R., and Martin, R. C. (2009). Gender and letters of recommendation for academia: agentic and communal differences. *Journal of Applied Psychology*, 94(6):1591–9.

Oaxaca, R. L. and Sierminska, E. (2021). Field specializations among beginning economists: Are there gender differences? *AEA Papers and Proceedings*, 111:86–91.

Paredes, V., Paserman, M. D., and Pino, F. J. (2020). Does Economics Make You Sexist? IZA Discussion Papers 13223, Institute of Labor Economics (IZA).

Sarsons, H. (2017). Recognition for group work: Gender differences in academia. *American Economic Review*, 107(5):141–45.

Sarsons, H., Gërxhani, K., Reuben, E., and Schram, A. (2021). Gender differences in recognition for group work. *Journal of Political Economy*, 129(1):101–147.

Schmader, T., Whitehead, J., and Wysocki, V. (2007). A linguistic comparison of letters of recommendation for male and female chemistry and biochemistry job applicants. *Sex roles*, 57:509–514.