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Women in economics: a UK perspective

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Abstract: The status of women in economics in the US has come increasingly under the spotlight. We exploit high-quality administrative data to paint the first comprehensive picture of the status of women in UK academic economics departments in research-intensive universities. Our evidence indicates that, as in the US, women in economics are under-represented and are paid less than men. The issues facing women in economics in the UK are similar to other disciplines, particularly STEM, but have received less national policy attention to date. We conclude with a discussion of interventions that might improve the status of women in academia and we present new evidence that a UK academic diversity programme (Athena SWAN) has narrowed the gender pay gap at a senior level.

Keywords: gender, affirmative action, academia, women in economics, gender wage gap

JEL classification: A14

I. Introduction

The status of women in economics in the US has been making national headlines. In January 2019 the *New York Times* wrote that female economists were pushing their discipline towards its #MeToo moment. Women are under-represented in US academic economics departments compared to men, particularly at the senior level (Lundberg and Stearns, 2019). They are also paid less than their male counterparts and are less likely to be promoted (Ceci *et al.*, 2014; Ginther and Kahn, 2004, 2009, 2014). A survey of American Economic Association members in 2019 revealed that just 20 per cent of women and 40 per cent of men were happy with the culture in economics (AEA, 2019).

The under-representation of women in economics matters. All disciplines need to draw on the widest possible talent pool. Increasing the share of women in economics is likely to affect the problems that economists work on (Chari and Goldsmith-Pinkham, 2017), the views that economists hold (May *et al.*, 2014; May *et al.*, 2018), and the certainty with which they hold them (Sarsons and Xu, 2015). Arguably diversity

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particularly matters in economics because of the unique role of economists in public life. The US President is advised by a Council of Economic Advisors, UK government departments have chief economists, the Monetary Policy Committee and the Federal Reserve Board make decisions about interest rates that affect the lives of millions. Improving diversity in economics will help to ensure that a diverse group of people helps to shape public policy.[1]

To date, a lot of discussion on the status of women in economics has focused on the US. This paper aims to close this gap. We exploit high-quality administrative data for the population of academics to paint the first comprehensive picture of the status of women in academic economics departments in research-intensive ('Russell Group'[2]) universities in the UK. This builds on recent survey evidence suggesting that women in economics are under-represented, and are paid less than their male counterparts in the UK, even after accounting for socio-demographic, workplace, and productivity-related characteristics (Mumford and Sechel, 2019). Our study is complementary to that of Auriol *et al.* (2019), who use web-scraping to provide broad evidence on women's status in economics across many European countries. We extend these studies in two ways. First, we use an administrative dataset that is comprehensive and covers the entire population of interest. Second, we compare economics with other subjects to shed light on whether there are general issues that face women in academia (women fare worse than men across all or many academic subjects) and/or a specific problem with the status of women in economics (women fare worse than men in economics; and the gender gaps are greater than in other subjects).

Evidence from the US indicates that the status of women in economics is worse than in other subjects. The gaps in pay and promotion are typically greater than in other maths-intensive disciplines, conditional on measures of productivity (Ceci *et al.*, 2014; Ginther and Kahn, 2004, 2009, 2014). Ceci *et al.* (2014) show that there is a bigger deficit between male and female academics' levels of satisfaction in economics than in other disciplines—and that, in contrast to other disciplines, the gap has grown over time (between 1997 and 2010).

There are reasons why economics might have a particular gender problem (see Bayer and Rouse (2016) for further discussion). Economics has a hierarchical nature in which quality is defined in narrow terms by publication in a 'top 5' set of journals (Heckman and Moktan, 2019) and competition for spots in these top journals is fierce.

[1] In focusing on gender, we are not assuming that this is the only important dimension for diversity. Ideally, we would take a more intersectional approach but there is limited data for a comprehensive assessment.

[2] Within the UK university sector, there is an historic divide between 'old universities' founded before 1992 (pre-1992) and 'new universities' which were former polytechnic colleges and higher education colleges, often focusing on more vocational training, which were granted university status after 1992 as part of a government drive to increase participation in degree-level education (post-1992). The Russell Group is a sub-set of 24 of the most research-intensive old (pre-1992) universities that typically outperform the rest of the sector in national and world rankings. They are: University of Birmingham, University of Bristol, University of Cambridge, Cardiff University, Durham University, University of Edinburgh, University of Exeter, University of Glasgow, Imperial College London, King's College London, University of Leeds, University of Liverpool, London School of Economics, University of Manchester, Newcastle University, University of Nottingham, University of Oxford, Queen Mary University of London, Queen's University Belfast, University of Sheffield, University of Southampton, University College London, University of Warwick, and University of York.

The discipline is also seen by some as having an aggressive culture. In an interview after being awarded the Nobel Prize, Esther Duflo reflected on the tradition of aggression and conflict in the profession: 'I think the profession is starting to realize the climate and the way we treat each other is not conducive for having more women in the profession'.[3] There is also, among some economists, a predisposition to place trust in the operation of markets and a belief that discrimination will be competed away that may make them reluctant to acknowledge that there may be persistent gender gaps.

In recent years, there is a burgeoning empirical literature identifying challenges facing women in economics. Women are less likely than men to have papers accepted at conferences (Hospido and Sanz, 2019). Women's papers improve more through journals' editorial process (Hengel, 2017) and their published papers get more citations (Card *et al.*, 2019). Women get asked more questions in economics seminars than men do—and more questions that are deemed to be unfair (Dupas *et al.*, 2020). Papers that women co-author with men count less for the promotion chances of women than of men (Sarsons, 2017). Economists on well-used discussion boards were also shown to use gendered language (Wu, 2018). Alongside Esther Duflo, other senior figures in the profession, including Ben Bernanke and Janet Yellen, have identified problems with the culture within economics, including bullying, harassment, and discrimination.[4]

These factors could affect women in economics departments outside the US. Economics is an international discipline—we show below that economics departments have a higher share of international academics than other subjects; departments from Europe, Australia, South-east Asia, South America, and increasingly India, have traditionally competed on the US 'job market' for the best talent; the journals which define quality in the US do the same elsewhere in the world.

However, disciplinary factors might be mitigated by the specific national contexts that universities operate in. The US higher education sector is highly competitive (Aghion *et al.*, 2010) with the largest share of the highest-ranked institutions in the world. US universities also operate largely autonomously from government and compete for resources—and, at least in the case of private institutions, have control over hiring and pay. Competition should reduce discrimination, but this may not be the case if there is implicit bias in the recognition of talent. Autonomy over hiring and pay may increase gender pay gaps (compared to a centralized system) by giving greater weight to, possibly biased, disciplinary norms.

The UK higher education sector (particularly the Russell Group of universities) shares some similarities with the US. The UK has traditionally out-performed other European countries in its share of the highest-ranked universities globally. The UK higher education sector is seen as competitive and there is considerable autonomy in hiring and pay (Aghion *et al.*, 2010). However there are some differences—there is a national pay scale (even if universities often pay off the scale), and progression and promotion processes are typically more centralized within universities than they are in the US.

[3] https://www.cnbc.com/2019/10/14/nobel-economics-prize-winner-esther-duflo-hopes-to-inspire-women.html

[4] https://www.nytimes.com/2019/01/10/business/economics-sexual-harassment-metoo.html.

The emerging picture of female representation in UK economics departments is one of similarity and differences compared to the US. Economics in the UK has a gender problem but in many dimensions, the problem is no worse than in other disciplines. We find that levels of—and trends in—female representation among UK economics faculty are similar to those in the US. Women are under-represented in economics, particularly at senior levels, with levels of representation closer to science, technology, engineering, and mathematics (STEM) than to other social science subjects. At the undergraduate level, STEM subjects have made progress in attracting more women, while economics has lagged behind. There is evidence of a gender pay gap in economics. At the non-professorial level, conditional on observable characteristics, women are paid on average 6 per cent less than men. This is nearly treble the disparity in STEM and other social science subjects, but is similar to business and management. At the professorial level, the gender pay gap in economics, at 3 per cent, is similar to STEM and other social sciences and smaller than business and management. There is no evidence of a gender promotion gap in economics, STEM, or other social sciences, but women lag behind men in promotion in business and management.

We end with a discussion of measures to close gender gaps. Evidence shows that publicizing gaps, mentoring junior female faculty, diversity plans, and objective assessment criteria can be effective. We present new evidence on a major UK diversity initiative to promote gender equality, the Athena SWAN accreditation programme, established in 2005 to encourage and recognize commitment to advancing the careers of women in science, technology, engineering, maths, and medicine (STEMM). In 2015 it was expanded to recognize work undertaken in arts, humanities, social sciences, business, and law (AHSSBL). Using a difference-in-differences strategy, we find that department-level accreditation reduces the gender pay gap by half at the professorial level.

II. UK higher education sector

The UK university sector comprises 158 institutions with degree-awarding powers. Our focus in this study is on 24 research-intensive, Russell Group universities. They are the most similar to the US universities captured in studies on the status of women in economics.

UK universities are relatively strong performers compared to the rest of Europe and the rest of the world in terms of their position in QS global rankings. They operate in a competitive environment, competing for resources from students and research funding bodies. Russell Group universities see themselves competing in international and national markets (for staff and students), while post-1992 universities focus more on local markets (McCormack *et al.*, 2014). Additional competitive pressure for research-intensive universities comes from regular research ranking exercises (the Research Excellence Framework (REF)).[5]

[5] Every 5–6 years, academics' research is peer assessed to produce a departmental ranking of the quality of outputs, impact, and research environment. De Fraja *et al.* (2019) show that average pay levels and pay inequality in a department are positively related to research performance. In particular, the salary benefits of REF performance are concentrated among the highest paid professors.

UK universities have a high level of autonomy from the government over budgets (Aghion *et al.*, 2010). At less than 30 per cent, the UK has the lowest share of public spending on higher education of any OECD country.[6] There is also autonomy over pay. In the study by Aghion *et al.* (2010), no respondent institution in the UK reported that faculty with the same rank/seniority would receive the same pay (the same was true for Belgium, Denmark, Finland, and Sweden); by contrast, the same pay is the norm in France, Ireland, Italy, Spain, and Switzerland. Prior to 2004, the UK had a nationally determined pay scale and there remains a single 51-point national pay spine to which individual institutions link their local pay and grading structures; universities have discretion to place staff posts on the spine and to raise salaries above the top of the scale, but this discretion operates within a national framework. Promotion processes are also typically more centralized than in the US and faculty-level committees operating across multiple departments are often the first decision-making committee. Thirty-three per cent of Russell Group managers report that hiring and promotion processes are centralized, compared to 75 per cent of former polytechnic managers (McCormack *et al.*, 2014).

III. Women in UK economics: a comparison with other disciplines

Our analysis exploits comprehensive administrative data covering the population of academic staff in the UK Higher Education Sector during the period 2013–16 (HESA, 2017).[7] We focus on academic staff in four major academic subject groups in the 24 Russell Group universities. As well as economics, we choose subject groups that are arguably natural comparators to economics, namely STEM, social sciences, and business and management. For a detailed explanation of how departments are matched to academic subjects, please refer to online Appendix A. We restrict the sample to academic staff with permanent teaching and research contracts. We have 55,285 observations over the period, 3,865 women (11,975 observations) and 13,030 men (43,310 observations). Table A2 in Appendix A lists all the universities in the sample and the academic departments in each of the four major disciplinary groups considered here.

The focus of our analysis is on the representation of women in different subjects and their pay and promotion compared to that of men. Table 1 provides summary statistics for the four subject groups. Table A3 in Appendix A describes in detail how variables are constructed from the HESA original variables. Even at this aggregated level, differences are clear. Economics has a low share of women—closer to STEM than to

[6] https://data.oecd.org/eduresource/spending-on-tertiary-education.htm OECD (2020), Spending on tertiary education (indicator), doi: 10.1787/a3523185-en (accessed on 17 January 2020).

[7] All statistics in this paper follow a level of aggregation to maintain anonymity of individuals and ensures no personal data or personal sensitive data are identifiable. We follow Higher Education Statistic Agency (HESA) standard rounding methodology to comply with HESA agreement. This implies that (i) counts of individuals are rounded to the nearest multiple of 5; (ii) percentages based on fewer than 22.5 individuals are suppressed; (iii) averages based on seven or fewer individuals are suppressed. Refer: https://www.hesa.ac.uk/about/regulation/data-protection/rounding-and-suppression-anonymise-statistics

Table 1: Summary statistics

	(1)	(2)	(3)	(4)	(5)
	All	**Economics**	**STEM**	**Social sciences**	**Business and management**
Panel A: Department characteristics					
Prop. women	0.226	0.200	0.165	0.421	0.331
Prop. professorial staff	0.340	0.353	0.355	0.297	0.304
Prop. part-time staff	0.060	0.059	0.060	0.060	0.052
Prop. female head of school	0.126	0.062	0.101	0.203	0.221
Prop. international staff	0.371	0.631	0.351	0.300	0.494
REF GPA	3.14	3.08	3.18	3.05	3.02
Average department size	45	37	47	29	74
Number of departments	312	21	210	57	24
Number of universities	24	21	24	23	24
Panel B: Individual characteristics by rank					
Non-professors					
Log real wage	10.85	10.86	10.85	10.82	10.84
Prop. women	0.259	0.244	0.201	0.428	0.397
Prop. part-time	0.044	0.022	0.048	0.043	0.033
Average age	43	40	43	42	41
Average years' tenure	10	8	11	8	7
Number of individuals	11,645	645	7,855	1,535	1,730
Number of observations	35,235	1,845	24,065	4,510	4,815
Professor					
Log real wage	11.28	11.42	11.25	11.27	11.41
Prop. women	0.142	0.138	0.113	0.299	0.204
Prop. part-time	0.093	0.142	0.084	0.104	0.116
Average age	52	52	52	53	52
Average years' tenure	15	12	16	13	10
Number of individuals	6,240	390	4,495	655	750
Number of observations	20,050	1,160	14,735	1,935	2,220

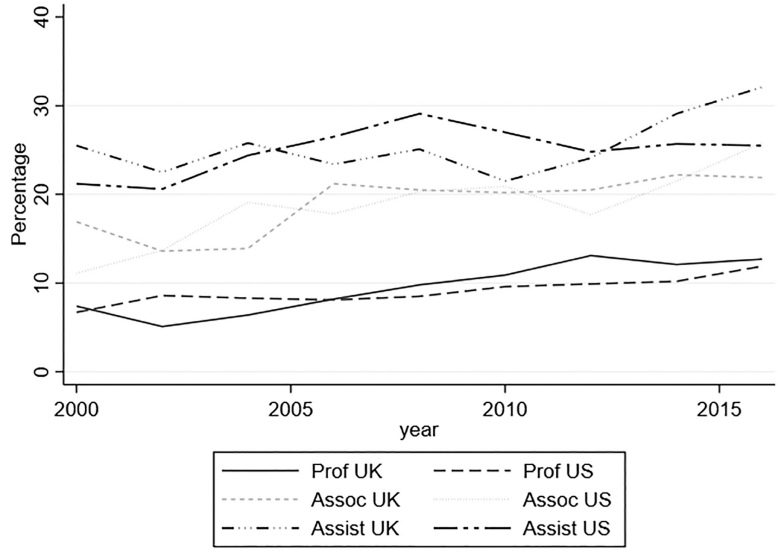
Notes: Source 2013–16 HESA dataset. Panel A presents average departmental characteristics. Panel B shows the average individual characteristics. Annual wages are censored at the top and the bottom 1 per cent salaries earned to prevent extreme outliers affecting mean salaries and are adjusted using 2016 CPI index. REF GPA refers to the score (out of 4) given to each department in the last Research Excellence Framework for the quality of its research. See Appendix A, Table A3 for a description of the variables.

business or other social sciences. It also has a higher share of professors, again closer to STEM. Salaries are typically high in economics compared to other subjects. This is true at both professorial and non-professorial levels. The share of international staff in economics departments is also the highest at 63 per cent, close to double the share of international staff in STEM and social sciences departments.

(i) Female representation

The share of women in economics departments has increased over the past decades (see CWEN (2015) for Canada; Lundberg and Stearns (2019), for the US; and Corsi *et al.* (2017), for Italy). However progress has been slow and women remain under-represented. Figure 1 uses data from the 2000–16 Royal Economics Society Women's Committee survey on 'Gender Balance of Academic Economics' to provide a historical benchmarking of the UK experience to that of the US (see Figure 1 in Lundberg and Stearns (2019)). The trend is very similar across the two countries. The

Figure 1: Trends in female representation in economics



Notes: UK data obtained from the 2000–16 Royal Economics Society Women's Committee survey on Gender Balance of Academic Economics for the 24 Russell Group universities (see Tenreyro, 2017). US data are taken from Lundberg and Stearns (2019) and cover the Chairman's group of 43 universities. 'prof' refers to full professor, 'assoc' refers to associate professor, and 'assist' refers to assistant professor.

share of female professors has almost doubled, increasing from 7.5 per cent in 2000 to 12.7 per cent in 2016 in the UK, and from 6.7 to 11.9 per cent in the US, while at the assistant professor level the increases have been from 27.8 to 32.1 per cent in the UK and from 21.2 to 25.5 per cent in the US.[8] Despite these increases, the share of women remains low. Women are under-represented at all levels and particularly at the senior level. The modest increases at the lower levels suggest that it will be a long time before parity is achieved and Lundberg and Stearns argue that progress has stalled in the US. By way of comparison, Auriol *et al.* (2019) report levels for Europe of 39 per cent women in entry-level positions (36 per cent at the top 100 institutions), 33 per cent (32 per cent at top 100) at associate level position, and 23 per cent (20 per cent) at professorial level. The under-representation of women in economics is a discipline-wide problem.

Table 2 compares economics with the three other subject groups and further compares the UK with the US (see Figure 3 in Lundberg and Stearns (2019)). The level of female representation is lowest in some science departments (chemistry and engineering, and maths/physics/computer sciences); female representation in economics is closer to science levels and is well below other social sciences. As in the US, the proportion of

[8] Comparison of balanced samples for 1996 (Mumford, 1997) and 2016 (Tenreyro, 2017), using the Royal Economic Society data, shows that the proportion of female economists increased from less than one-in-six in 1996, to more than one-in-four in 2016. Our numbers are smaller as a result of restricting the sample to Russell Group universities.

Table 2: Female Representation in the US and the UK across academic subjects

	UK		US		
	Prof	**Non-prof**	**Prof**	**Assoc**	**Assist**
Economics	0.138	0.245	0.099	0.177	0.248
Chemistry and engineering	0.093	0.170	0.096	0.162	0.250
Maths/physics/computer science	0.094	0.164	0.101	0.181	0.227
Biology/earth sciences	0.162	0.289	0.167	0.302	0.332
Politics and international studies	0.191	0.341	0.222	0.351	0.404
Psychology	0.288	0.461	0.327	0.438	0.503
Sociology	0.421	0.543	0.333	0.541	0.636

Notes: US data cover the Chairman's group of 43 universities and is taken from Lundberg and Stearns (2019). The UK data are for the 24 Russell Group universities and are taken from the HESA dataset as explained in Appendix A. We use our sample to construct this table, as explained in section III, and additionally introduce academic staff in psychology departments for comparison purposes. 'Prof' refers to full professor, 'Assoc' refers to associate professor, 'Assist' refers to assistant professor and 'Non-Prof' refers to an aggregation of associate and assistant professors.

women in social sciences (42 per cent) and business management (33 per cent) is almost double the share of women in economics (20 per cent) and STEM (16 per cent).

Multiple initiatives in the UK and other countries, including many government-funded programmes, have focused on the need to encourage female take-up of STEM subjects (see House of Commons (2016) for a summary). These initiatives have succeeded in increasing the share of women at the start of the pipeline in some STEM subjects. The share of women studying for a biology degree is 60 per cent; in chemistry, it is 42 per cent; in maths, it is 36 per cent, although it remains low in physics (21 per cent) and computer science (14 per cent). The share of women in economics at undergraduate level is also low at 28 per cent. Only relatively recently has attention turned to the importance of encouraging more women to study economics at undergraduate level (Crawford *et al.*, 2018; Avilova and Goldin, 2018). We would argue that the persistent under-representation of women—and the lack of diversity more generally—needs to be given the same kind of attention as was given to women in STEM, given the role of economists in policy-making.

(ii) Gender pay gaps

Table 3 summarizes average real annual earnings (£) for the four subject groups, by academic rank. Two things stand out. First, salaries in economics are consistently higher than those in the other subject groups, although close to those in business and management.[9] Second, women earn less than men in all subject groups and in both ranks. The raw gender pay gap is particularly acute at the professorial level, and especially for individuals in the highest paid disciplines (economics and business management).

[9] These figures are consistent with Table A.1 in Mumford and Sechel (2019) who report average gross annual earnings of £73,109 for male economists and £60,418 for female economists from a 2016 survey of 668 academic staff working in economics departments in the UK.

Table 3: Average salaries (£, 2016 prices)

	Non-professors		Professors	
	Female	**Male**	**Female**	**Male**
Economics	50,937	54,385	87,339	95,260
No. of individuals	165	480	60	330
No. of observations	450	1,395	160	1,000
Business and management	49,808	54,242	85,760	94,009
No. of individuals	680	1,050	155	600
No. of observations	1,910	2,905	455	1,765
STEM	50,695	52,908	74,942	78,689
No. of individuals	1,665	6,190	555	3,940
No. of observations	4,825	19,235	1,665	13,070
Social science	49,744	51,679	76,481	80,835
No. of individuals	665	875	200	455
No. of observations	1,930	2,580	580	1,360

Notes: Source is HESA data 2013–16. Earnings distributions are censored at the top and the bottom 1 per cent.

We estimate a standard 'wage' equation to determine the extent to which there is a gender pay gap when we include controls:

$$log\_w_{ijst} = \alpha + \beta F_i + X_{it}\gamma + \pi_t + \eta_j + \mu_s + \varepsilon_{ijst}.$$

The dependent variable is the log real annual salary (w_{ijst}) of individual i in university j in subject s at time t. F_i is a binary indicator = 1 for female academics. β is our main coefficient of interest. The vector X_{it} includes time-varying individual characteristics. We do not have any information on children, which have been shown to affect earnings, nor direct measures of productivity, but we include variables that are correlated with productivity in the literature, i.e. age and age squared to proxy for experience, and employment characteristics such as tenure, tenure squared, and a part-time indicator (Blackaby *et al.*, 2005; Mumford and Sechel, 2019). Panel B in Table 3 shows all the summary statistics for these variables for each discipline, and Table A3 in Appendix A describes how these variables are constructed. We additionally control for year dummies (π_t), and university dummies (η_j). When appropriate (in STEM and social sciences disciplines) we also control for academic subjects within the subject groups (μ_s). We estimate this equation by subject group, separately for professors and non-professors. ε_{ijst} is the error term and is clustered at the department level.

Columns 1 and 3 in Table 4 present benchmark estimates of the raw gender pay gaps—confirming that they are highest in economics and business and management. Adding controls has little effect on the magnitude of the gender pay gaps in non-professorial salaries. At this lower level, the conditional gender pay gap in economics (6 per cent) is similar to that in business and management (5 per cent) and almost treble that in STEM and the other social sciences (2 per cent). At the professorial level, the conditional gender pay gap narrows in economics and, at 3 per cent, is the same as in STEM and other social sciences, albeit less precisely estimated. At the professorial level, the conditional gender pay gap is greatest in business and management (5 per cent).

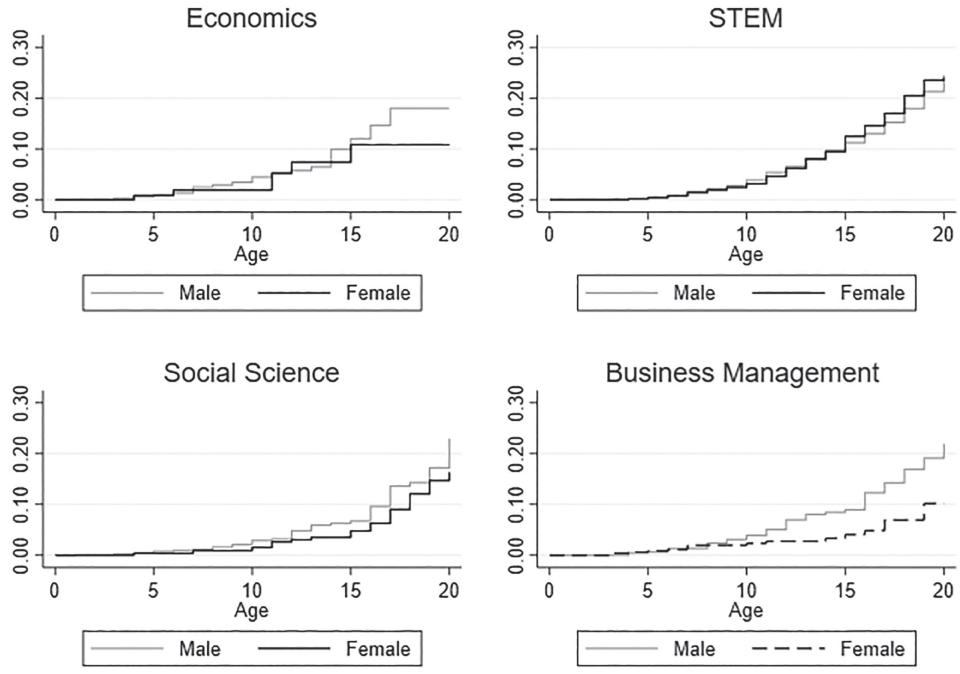
Table 4: The gender pay gap (dependent variable = Ln(real annual salary)

	Non-professors		Professors	
	(1) No controls	(2) Controls	(3) No controls	(4) Controls
Panel A: Economics				
Female	–0.058***	–0.058***	–0.082**	–0.034
	(0.020)	(0.010)	(0.033)	(0.027)
No. of Individuals	645	645	390	390
No. of Observations	1,845	1,845	1,160	1,160
R-squared	0.013	0.491	0.013	0.446
Panel B: Business and management				
Female	–0.067***	–0.053***	–0.084***	–0.054***
	(0.013)	(0.010)	(0.020)	(0.014)
No. of Individuals	1,730	1,730	750	750
No. of Observations	4,815	4,815	2,220	2,220
R-squared	0.020	0.467	0.021	0.425
Panel C: STEM				
Female	–0.039***	–0.022***	–0.046***	–0.036***
	(0.005)	(0.004)	(0.009)	(0.006)
No. of Individuals	7,855	7,855	4,495	4,495
No. of Observations	24,065	24,065	14,735	14,735
R-squared	0.008	0.478	0.005	0.307
Panel D: Social Science				
Female	–0.035***	–0.020***	–0.052***	–0.033***
	(0.011)	(0.006)	(0.014)	(0.009)
No. of Individuals	1,535	1,535	655	655
No. of Observations	4,510	4,510	1,935	1,935
R-squared	0.008	0.534	0.016	0.432

Note: Source is HESA data 2013–16. Earnings distributions are censored at the top and the bottom 1 per cent salaries. Controls are age, age squared, tenure, tenure squared, part-time indicator, university fixed effects, and time fixed effects. Subject fixed effects are included when appropriate (i.e. for STEM and social sciences with more than one subject). Robust standard errors are clustered at the department level and are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

These estimates confirm the findings of previous studies that there are gender pay gaps in academia even when comparing like with like. The estimated gaps in economics are smaller than that reported by Mumford and Sechel (2019), who show a gap of 12.7 per cent after including demographic, productivity, workplace, and labour market related characteristics for a sample of 367 academic staff in UK economics departments in 2016. However, their study is not directly comparable because of the self-selected nature of their sample. Ward (2001) analyses a survey of academic staff in five of the eight old Scottish universities in 1996, showing that medicine has the highest raw gap, followed by science and social science disciplines. In the US, Ceci *et al.* (2014) use data on the 2010 Survey of Doctorate Recipients, show that the gender gap among economics professors is worse than that for professors in engineering, geoscience, and physical science and for associate professors in life sciences. Tao (2018) uses several waves of data from the National Science Foundation from 2003 to 2013 to document that women earn about 5 per cent less than men after controlling for demographic, educational, productivity, and employment-related characteristics.

Figure 2: Promotion to professor



Hazard ratio	Economics	Business and management	STEM	Social sciences
(A) Raw data	0.740 (0.338)	0.477 (0.173)	1.020 (0.103)	0.687 (0.173)
(B) Including covariates	0.820 (0.393)	0.506 (0.153)	1.118 (0.116)	0.822 (0.218)

Notes: Source is 2013–16 HESA dataset. Graphs plot the hazard rate. The table presents the female–male hazard ratio. Covariates are university and subject.

(iii) Gender promotion gaps

Our estimates of gender pay gaps by academic grade (professor/non-professor) may be misleading if women take longer to reach higher grades. US studies have found a significant gender promotion gap in economics, albeit one that is narrowing over time. Ginther and Kahn (2004) find a 18 ppt gap in achieving tenure within 10 years for the 1972–91 cohorts of PhD students; Ginther and Kahn (2006) find a 12 ppt tenure gap for the 1981–2003 PhD cohorts; and Khan (2020) finds a 4.5 ppt tenure gap (cohorts after 2000).

Figure 2 plots hazard rates for promotion to professor (from non-professor), by subject group, for men and women. We expand the dataset to create age histories back

to age 30 and include promotions to non-Russell Group universities. Estimates from a Cox proportional-hazards model, including controls for university and subject, are presented below. The promotion rate for women is below that for men in economics—including controls, the estimates indicate that the promotion rate for women is around 80 per cent that for men. Promotion rates are also lower for women in social science and business and management. The gender gap is greatest—and statistically significant—for business and management. In STEM, the promotion rate for women is greater than that for men, but the gap is not statistically significant.

IV. Closing gender gaps in economics and academia

Our results show that women lag behind men in academia—in levels of representation, pay, and, for some, promotion. While it is important to identify problems, it is also important to offer solutions and to identify practical measures that might help to improve women's status in academia. In this section we review a growing literature offering causal evidence on policy interventions that work—as well as on policy interventions with mixed results (see also Buckles (2019) for discussion of initiatives to close the gender gap in economics, and Behavioural Insights Team (2018) for a broader review). We focus our discussion on policy interventions designed to close the gender gap among academics, rather than policies to encourage more women to study economics. The latter is an important but separate challenge. We take for granted that generous maternity provision and flexible working arrangements are important (see Epifanio and Troeger, 2019).

(i) What has worked well?

Data

The first step in tackling a problem is to admit that there is a problem. Professional societies' Women's Committees have spent years collecting and publishing data showing the under-representation of women in the economics profession (see Tenreyro (2017) for the UK). Many initiatives to address gender gaps have followed from the growing recognition that there is persistent under-representation of women in economics, particularly at higher levels, that cannot be attributed to a cohort effect.

Is there also a direct effect from collecting and publishing data? Some organizations have actively collected evidence out of a desire to identify—and then address—their gender gap problem. Econometric analysis of academics' pay commissioned by the LSE's Equity, Diversity and Inclusion (EDI) Taskforce, for example, led directly to a pay increase for women (see Bandiera *et al.*, 2016).[10] Externally-imposed requirements to publish pay gap information can also bring about change. Bennedsen *et al.* (2019) showed that the requirement for Danish firms to publish gender pay gap information resulted in a narrowing of the gap for firms which had to publish (largely achieved

[10] https://www.timeshighereducation.com/news/london-school-of-economics-give-female-academics-pay-rises-close-gap-men

through a reduction in pay increases for men). More work is required to understand whether the mechanism is to highlight a problem that organizations were unaware of or to shame them into taking action.

Mentoring and networking

Professional societies in economics have run mentoring programmes for junior female academics for nearly 20 years. The Committee on the Status of Women in the Economics Profession (CSWEP) introduced a programme for US-based junior women in 2004, followed by the Royal Economic Society for UK-based academics in 2012, and by the European Economic Association for European-based academics since 2013. The mentoring programmes run by these different organizations follow a broadly common format with a mix of plenary sessions delivered by senior (female) academics covering different aspects of academic life (getting published, writing grants, networking, work–life balance, teaching) and small-group research-focused sessions providing detailed feedback on junior academics' papers. Blau *et al.* (2010) evaluated outcomes for the first three cohorts of mentees who took part in the CSWEP mentoring programme. Places on the over-subscribed programme were allocated at random, allowing a randomized controlled trial evaluation comparing outcomes for 205 mentees who were in the treatment group and 163 mentees who acted as a control. The evaluation found that participating in the programme had a positive effect on the number of publications and grants. A follow-up study (Ginther *et al.*, 2020) showed that the longer-term outcomes were also positive, with participants enjoying a significantly higher probability of tenure at a higher-ranked institution (defined as within the top 50), driven by a higher probability of more grants and better publications.

This is a positive story for individuals who take part in the mentoring programme offered by CSWEP. It would be interesting to see whether the UK and European schemes have similar effects and also to understand the channel(s) through which mentoring achieves the positive effects. It may work by providing information to junior academics (e.g. about the journal publication process) and/or by offering (senior) female role models and/or by helping junior academics to build networks. Ductor *et al.* (2018) show that male academic economists connect to a larger number of co-authors, while women have smaller networks, i.e. they are more likely to co-author with the same people (and the co-authors of co-authors). These smaller networks, they argue, may explain why women typically write fewer papers than their male counterparts.

Diversity plans

Hospido *et al.* (2019) report on a successful diversity action plan introduced by the European Central Bank (ECB) to close the gender gap in promotion to senior management. In 2010, the ECB launched a diversity initiative with a clear public statement, a well-defined focus (attracting female candidates, enhancing the internal pipeline of female candidates, facilitating work–life balance, and increasing accountability and commitment) and a specific gender target (35 per cent women by 2019) for managerial positions. There was an increase in the representation of women on selection panels (allowing the inclusion of a member from another business area if

this enhanced the gender diversity of the selection committee) and a mentoring programme. The plan succeeded in closing the gender promotion gap from 35 to 8 per cent, with many more women being encouraged to apply for promotion. This is an important issue in academia—analysing French data, Bosquet *et al.* (2019) report that women are 50 per cent less likely to be promoted, and that 50–75 per cent of this gap can be explained by the fact that they are less likely to apply for promotion (the rest of the gap is attributable to productivity differences). This is a very promising initiative which has had a sizeable impact. The fact that there are several elements makes it hard to know what exactly accounted for the success, although Hospido *et al.* (2019) rule out that increasing the number of women on selection committees had an effect. Behavioural Insights Team (2018) emphasizes specific targets as having a positive effect.

Objective assessments

Reviewing policies to reduce gender gaps, the Behavioural Insights Team's report also highlighted the importance of objective assessments (covering skill-based tasks and structured interviews, and transparency in promotion and pay and reward schemes) among its 'policies that work'. There are many dimensions in which academic recruitment, promotion, and pay processes deviate from this ideal, not least in the (disproportionate) role played by subjective assessments. The evidence (Sarsons, 2017) that women who co-author with men face a lower promotion probability is symptomatic of a process in which potentially gender-biased subjective judgements can affect outcomes.

Evidence suggests that two (other) sources of information used in the assessment process may be subject to gender bias.

The first is student evaluations. Evidence from France (Boring, 2017), the Netherlands (Mengel *et al.*, 2019), and the US (MacNell *et al.*, 2015) shows that female academics receive worse evaluations from male students despite there being no difference in objective performance. In the recent American Economic Association (AEA) climate survey, 47 per cent of female academics said that they had personally experienced discrimination with regard to course evaluations (compared to 8 per cent of male). Promisingly, a recent study by Boring and Philippe (2017) showed an informational treatment (telling students that previous cohorts of males were biased against female instructors) caused male students to increase their scores. A simple normative treatment asking students to be aware of possible biases had no effect.

The second is assessor letters, which play an important role in hiring and promotion decisions. There is no evidence for economics, but a number of studies highlight differences in the language used in reference letters written for men and women. Letters written for women have more 'doubt-raisers', i.e. phrases which suggest some element of doubt about the candidate and fewer brilliant assessments (Schmader *et al.*, 2007; Madera *et al.*, 2009; Dutt *et al.*, 2016; Madera *et al.*, 2019). Williams and Ceci (2015) find that academics generally show a preference for hiring a woman over a man in STEM subjects, but the same was not true for economics. However, there is no preference for hiring a woman over a man perceived to be more qualified—and slightly worse student evaluations/letters of assessment may tip the balance.

(ii) What has worked less well?

Diverse selection panels

Many institutions, when faced with gender gaps in promotion and hiring, try to address the problem by instituting diverse selection panels. However, there is no evidence that diverse selection panels have a positive effect on women's success. As already described, Hospido *et al.* (2019) report that an increase in the share of women had no effect on female promotion in the ECB. Bagues *et al.* (2017) similarly find that more women on academic selection panels do not increase the number or quality of women who are chosen. Female evaluators are not significantly more favourable towards women, while male evaluators become less favourable to women. In their study of implicit bias, Moss-Racusin *et al.* (2012), show that women are just as likely to show bias against women as men are. The Behavioural Insights Team report (2018) finds no systematic evidence that diversity training has a positive effect on outcomes for women.

Moreover, the push to have more panels may harm some women's promotion prospects by requiring them to sit on more panels and spend more time on administrative tasks that attract lower rewards in academia compared to prestigious research publications. Guarino and Borden (2017) find that women do more academic service—particularly internal service—than their male counterparts (and that the disparity is particularly great for female professors who may lose out on pay increases if not promotion). In a novel lab experiment, Babcock *et al.* (2017) show that, even in the absence of diversity initiatives which may increase the amount of time women devote to administrative tasks, women are more likely to be asked to volunteer for unrewarded public-service tasks—and are more likely to say yes to such requests.

Women taking on major administrative roles can have a positive effect on outcomes. Langan (2019) reports that having a female head of department is associated with a reduction in gender wage gaps in the US. Analysis of department-level HESA data points to similar effects in the UK. In social science, STEM, and business, female heads are associated with a higher female share and a smaller gender pay gap. Of course this evidence is not causal—there is a negative association in economics between having a female head of department and female representation; this may indicate an attempt to hire a female department head to address a gender problem.

Stopping the clock

In some cases, policies that are intended to support women and to close gender gaps can actually backfire. Antecol *et al.* (2018) report on the effects of a 'stop the clock' policy, i.e. a policy of granting additional time to fixed tenure-track periods for people who have children. Such policies were applied blindly such that all new parents benefited, irrespective of whether they actually did any childcare, and turned out to benefit men much more than it did women. Such policies were associated with a 19 percentage-point rise in the probability that a male economist would earn tenure at his first job—and a 22 percentage-point fall for women. In essence, the men used the extra time to publish more and raised the bar for women. This evidence is instructive in that it shows the potential pitfalls that may arise; however, it does not mean that it is impossible to find policies that help carers deal with the consequences of caring for their careers. Policies that appropriately lower thresholds may offer an alternative way forward.

(iii) Athena SWAN

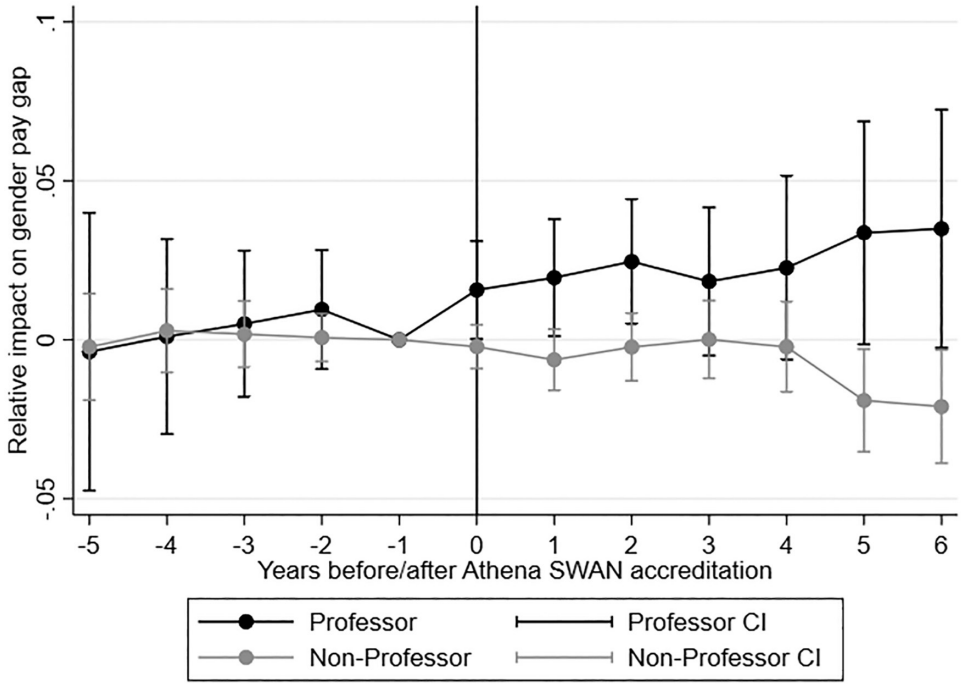
Finally, we present new evidence on the effects of a unique UK initiative: the Athena SWAN Charter. This was established in 2005 to advance the careers of women working in STEM disciplines in higher education. In 2015 it was expanded to recognize work undertaken in arts, humanities, social sciences, business, and law (AHSSBL). Athena SWAN awards are given—at bronze, silver, or gold level—to institutions that are committed to gender equality. The application process requires an institution to conduct a comprehensive audit of gender equality, and to make proposals for change, i.e. measures to overcome gender equality challenges (e.g. more transparent process for appointing heads of departments, career track schemes to help women to move from fixed-term contracts to permanent contracts, support with staff review and development processes). There are no explicit targets for female employment or wages, nor does Athena SWAN dictate specific interventions that universities need to put into place. There is no requirement for institutions to make a submission, although it is increasingly important for funding applications (Gregory-Smith, 2018); and it is a sign of an institutional commitment to gender equality. There is a two-step accreditation process—first at the university level and then, once the university is accredited, departments can apply for accreditation. Preparing the departmental-level submission is a lengthy and relatively costly process drawing in several (7–13) people within a department to form a self-assessment team to prepare the required quantitative and qualitative data and to do the analysis and self-reflection for a successful submission. The self-assessment team is required to collect evidence on the representation of women at different levels and on gender differences in recruitment, retention, and progression/promotion, and to consider the impact of practices (seminars, social events) and policies (flexible working, training, etc). In total the process of putting together a submission is typically estimated to take 18 months. Gamage and Sevilla (2019) show that university accreditation had a modest effect on closing the gender pay gap; they found little effect of university-level accreditation on female representation. Here we focus on department-level accreditation.

We study the relationship between department-level accreditation and gender pay gaps. We merge the 2009–16 individual-level data with a self-constructed dataset containing information on accreditation dates obtained from the published information in the Athena SWAN booklets (see online Appendix B for a detailed description of how the data set is constructed. Unfortunately we only observe the outcomes of successful applications.) As in our main analysis, we restrict the sample to academic staff with permanent teaching and research contracts and we focus on 155 (out of 182) STEM departments in the 24 Russell Group universities that have received accreditation. The focus on STEM is because of the more widespread accreditation among STEM departments in our dataset—the charter was only extended to AHSSBL in 2015 (see Appendix B, Table B4 for a comparison of data for accredited/non-accredited STEM departments). Our sample has 67,365 observations for 2,085 female academics (10,360 observations) and 10,330 male academics (57,005 observations).

We employ a difference-in-differences analysis. We compare female pay (our treatment group) to that of males (our control group) and use an event study approach to look at what happens to female pay relative to male pay for each year before/after Athena SWAN accreditation,[11] i.e.:

[11] We cannot rule out that Athena SWAN accreditation might affect male wages, but the focus of our analysis is on whether the effect is different for women and men.

Figure 3: Evolution of female pay relative to male pay, before/ after Athena SWAN accreditation



Notes: Source is 2009–16 HESA dataset. Sample is 155 STEM departments that have received Athena status by 2016 and that we can include in the event study analysis. The figure plots the estimated differential effect of Athena SWAN accreditation on female pay relative to male pay. One year before Athena SWAN accreditation is used as the reference year. A positive coefficient indicates a narrowing in the gender pay gap.

$$\log w_{ijst} = \alpha + \beta F_i + \sum_{n=-5}^{n=-2} \gamma_n A_{jst+n} + \sum_{n=0}^{n=6} \gamma_n A_{jst+n} + \\ + \sum_{n=-5}^{n=-2} \gamma_n F_i \times A_{jst+n} + \sum_{n=0}^{n=6} \gamma_n F_i \times A_{jst+n} + X_{it}\varphi' + \ \pi_t + \mu_s + \eta_j + \gamma_{\mathrm{j}}\mathrm{t} + \varepsilon_{ijst}$$

where log_w_{ijst} is the log real salary (using 2016 as the base year) of individual i in a subject s, university j, and year t. $A_{jst}$is a binary indicator that takes the value 1 for a subject s that is awarded Athena SWAN accreditation in year t, and 0 otherwise. We interact this with an indicator for female. X_{isjt} is a vector of characteristics that are known to be correlated with wages. The coefficients of interest are related to these interaction terms—i.e. the evolution of female pay relative to male pay. We also include university dummies η_j, subject dummies μ_s, and time dummies π_t. The university and subject dummies address unobserved and time-invariant university- and subject-specific factors that are potentially correlated with wages, such as the fact that higher-ranked universities pay higher salaries. The time dummies account for aggregate level shocks potentially impacting wages in academia, as could have been the case with the 2008–9 downturn. University-specific time fixed effects ($\gamma_{\mathrm{j}}\mathrm{t}$) capture a variety of unobserved

time-varying university-level traits that might remain unaccounted for (including university accreditation).

We estimate the equation separately for professors and non-professors. The main coefficients of interest are plotted in Figure 3 below. The full regression results are given in Appendix B, Table B5. We see that, whereas women's pay in non-professorial ranks is not affected, relative to the pay of men, the pay of female professors increases relative to that of their male counterparts after Athena SWAN accreditation. The overall effect is equivalent to halving the gender wage gap from 5 percentage points to less than 3 percentage points. Of course, there may be some limitations in giving this result a causal interpretation. Athena SWAN accreditation is an endogenous decision by departments—they choose whether and when to apply. Another potential concern is that there is a substantial time lag between starting to apply and completing the submission, due to the process of conducting an internal audit and pulling together the necessary quantitative and qualitative data that go into a submission. For both of these reasons, we might expect to see differential trends in male/female pay (i.e. non-zero coefficients) in the pre-period, but there is no evidence of this in the data. Indeed, the date of accreditation (or at least the date of submission) appears to be the key turning point in the gender pay gap for professors. One reason may be that drawing up a plan for improving gender equality is likely to come towards the end of the process, close to the date of submission. Departments are assessed on their progress when they have to re-apply for accreditation after 3 years and so will be looking forward from the date of submission to work towards fulfilling the promises that they have made.

V. Discussion

Analysis of high-quality, administrative data reveals gender gaps in economics. Women are under-represented, particularly at a senior level, and are paid less than their male counterparts. The status of women in economics is not systematically worse than in other disciplines, but it is similar to STEM subjects. Discussion around encouraging women in STEM has been high profile, including national, government-funded initiatives. To date, the status of women in economics has not received similar attention, despite the role of economists in national policy-making and the importance of diversity in the discipline.

Positive steps are required to improve the status of women in economics. This includes measures to attract more female students to study economics (not the focus of this paper) and measures to support women in economics. For the latter, the literature identifies mentoring and diversity plans as likely to be the most effective. The European Central Bank diversity plan, including explicit targets and a bundle of measures to support women, shows what can be done. Our evidence suggests that the UK Athena SWAN initiative has helped to close the gender pay gap among senior academics; extending Athena SWAN from STEM to other subjects is therefore a positive step, although more needs to be done to close gender pay gaps at junior levels and to improve the representation of women in economics. The literature also highlights the importance of using objective assessment processes; academic promotion relies on both student evaluations and assessment letters which may be subject to bias.

Support for female academics is even more important in the current time. The closure of schools and nurseries to stop the spread of coronavirus has left women bearing the brunt of the additional childcare even when they are working (Sevilla and Smith, 2020). There are early indications that this is having a negative effect on the productivity of mid-career women—shown by a smaller share of research papers on COVID 19 among leading working papers series (Amano-Patino *et al*., 2020). Even if the disruption is relatively short-lived, it may have long-lasting effects, causing gender gaps to widen further, unless those with caring responsibilities are given support.

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