



Young
Scientists
in Africa

Factors that affect scientific production in Africa: a gender analysis

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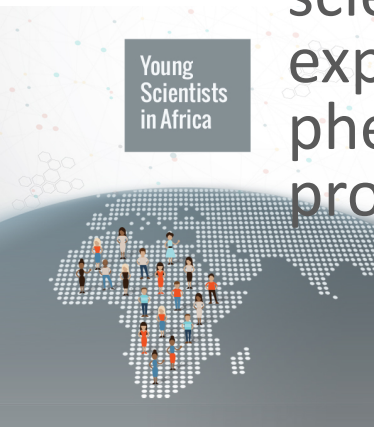
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Research question

- The consistent finding globally that the scientific production of female researchers is lower than that for men (Huyer, 2015; Larivière, Ni, Gingras et al., 2013)
- However, research on scientific production of researchers in Africa, especially in gender-disaggregated form, is scarce, partly because, until recently women scientists were “so rare in Africa as to be nearly invisible” (Campion & Shrum, 2004)
- Even after half a century of empirical research on gender differences in scientific production conducted in developed countries, no single explanation or group of explanations satisfactorily accounts for the phenomenon aptly referred to by Cole and Zuckerman (1984) as “the productivity puzzle”.



Possible explanations for the gender gap

- The extent to which a gender gap in publication output can be ascribed to the following:
 - a gendered division of academic labour, in that women spend more time on teaching tasks, while men spend more time on research tasks;
 - a gendered division of care work, in that women's heavier family-related responsibilities limit their time and energy, as well as geographic mobility, to a greater extent than is the case for men;
 - unequal access to the means of scientific production, in that women have less access to research funding than men do;
 - unequal access to collaborative opportunities, in that women have a lower propensity than men to collaborate with other scientists;
 - differences between men and women in terms of chronological age, in that women scientists are on average younger than men;
 - “horizontal” gender segregation, in that women are more likely to be working in the social sciences and humanities than in the natural sciences and engineering.



Survey design

- Extracted corresponding authors' emails from
 - Web of Science and Scopus databases for each article with an institutional address in Africa from 2005 to 2015
 - Non-indexed journals for Zambia, and the South African Knowledgebase database
 - The Internet, as well as snowball sampling
- Self-administered, structured web-based questionnaire
 - Divided into 10 sections: Educational Background, Employment, Working Conditions, Research Output, Funding, Challenges, International Mobility, Collaboration, Mentoring, and Demographic Background (36 items)
 - Piloted in Zambia



Population and sample size

Country	Total emails	Valid emails	Number of responses	Response Rate	Country	Total emails	Valid emails	Number of responses	Response Rate
South Africa	29,541	22,824	2,557	12.37%	Senegal	1,111	903	120	13.30%
Nigeria	12,179	11,235	971	9.85%	Botswana	853	728	87	13.28%
Algeria	11,560	9,584	568	5.90%	Burkina Faso	771	563	85	15.10%
Egypt	19,095	16,123	532	3.64%	Ivory Coast	883	716	78	10.90%
Tunisia	13,304	11,284	434	3.80%	Malawi	824	662	63	10.77%
Kenya	5,406	3,928	345	9.06%	Benin	629	469	57	12.20%
Morocco	7,989	6,434	343	5.30%	Congo	362	292	33	11.30%
Ethiopia	2,883	2,374	252	11.28%	Togo	223	182	28	15.40%
Uganda	2,579	2,174	205	10.48%	Madagascar	465	336	27	8.00%
Ghana	2,312	1,924	187	10.75%	CAR, Guinea, Seychelles, Chad, Burundi, Comoros, Djibouti	338	257	25	9.70%
Cameroon	1,808	1,402	170	12.10%	Congo (Dem. Rep.)	202	168	21	12.50%
Tanzania	2,204	1,738	142	8.72%	Mali	344	262	20	7.60%
Zambia	1,457	1,077	128	15.61%	Niger	334	272	19	7.00%
Zimbabwe	1,008	877	125	16.38%	Gabon	258	202	18	8.90%
Total						113,325	92,978	7,515	10.40%

Multiple emails per individual

Final sample 5,370 complete observations

Gender distribution

For some countries, our sample is representative of gender distribution

Country	Year Data UIS	UIS	Our sample
Burkina Faso	2010	23%	18%
Cameroon	2008	22%	7%
Ghana	2010	18%	17%
Kenya	2010	26%	32%
Morocco	2012	32%	23%
Nigeria	2007	23%	17%
South Africa	2013	44%	46%
Tunisia	2015	55%	43%
Uganda	2010	24%	27%
Zambia	2008	31%	24%
Zimbabwe	2012	25%	19%

Fields	Gender proportion by field		Field distribution by gender	
	Male	Female	Male	Female
Nat. sc.	74%	26%	31%	26%
Agri. Sc.	76%	24%	12%	9%
Eng. & app. tech.	82%	18%	14%	7%
Health sc.	64%	36%	21%	28%
Humanities	62%	38%	4%	7%
Social sc.	63%	37%	16%	22%

Women are better represented than men in the health sciences & SSH

Sample mainly composed of women in the natural, health and social sciences

Sample description (I/II)

- 30.4% of the respondents are women (dFemale)
- Average age (Age) of the researchers surveyed is 46
- Average number of children (nbChildren): 1.86
- On average these researchers contribute to 43.8% of housework and care-work for all dependents (propCareMe)
 - women declare to contribute to 57.7% of these chores
 - while men declare 37.8%.
- 30% of the respondents are based in South Africa (dHomeSA)
 - which also accounts for more than 40% of our female researchers)
- 51.8% obtained their highest qualification in the STEM fields (dSTEM), 24.2% in the health fields (dHealth) and 24% in the SSH fields (dSSH)
- 36.4% of the researchers surveyed have studied or worked abroad in the past three years (dMobility)

Sample description (II/II)

- These researchers have published 8.5 articles (nbArticles) over the past three years
- They had access to 94,000\$ of research funds (Funds) over the same period
- These researchers collaborate
 - often with colleagues of their own institutions (oCollOwnInst)
 - sometimes with colleagues in their own country (oCollOwnCount) and internationally (oCollOutAfrica)
 - rarely in other countries in Africa (oCollAfrica)
- The task that occupies them most is
 - undoubtedly research (nbWHResearch – on average 10.8 hours a week)
 - followed by teaching (nbWHTeaching – 7.7 hours a week)
 - administration (nbWHAdmin – 5.8 hours a week)
 - supervising graduate students (nbWHSupervising – 5.6 hours a week)



Working hours

Nb work. hours	Men	Women	
Teaching	7.892	6.821	***
Supervising	5.238	5.819	**
Research	10.604	11.053	
Administration	5.241	6.386	***
Service	2.420	3.014	***
Consulting	2.047	1.602	***
Fundraising	1.759	2.056	***
Total	36.113	37.693	***

- Women do 1.6 more hours' work than their male colleagues
- Surprisingly, men devote 1.1 hours more to teaching than their female colleagues, which contradicts the literature
- Except for hours per week devoted to consulting and research, all academic tasks are reported as more time-consuming by female researchers



Research funds raised

	South Africa	Rest of Africa	M-W test
Men	\$100,706	\$88,788	***
Women	\$86,961	\$109,554	***
M-W test	***	***	

- Female scientists raise less research funds than their male counterparts
- In our sample however, female scientists report having raised slightly more than \$99,000 in research funds over the past three year, whereas men have only managed to raise more than \$90,000 during the same period
 - An important difference stems from the origin of the funds: for men, the majority (55%) of their funds originate from international organisations, while for women, more than 65% of their funds are provided by national organisations.
- South African female researchers are better funded than men, while in the rest of the continent, the opposite applies
 - We suspect that there is also a scientific field or discipline effect, but once we account for differences in gender, country and field, the sub-samples are no longer large enough to be representative



Career obstacles (I/II)

- A higher percentage of men than women report that a lack of research funding in general, and funding for research equipment specifically, has impacted negatively on their career
 - (M: 54.4% and 52.2%; W: 40.5% and 35.0%)
- Comparing South Africa (M: 64.1%, W: 56.4%) and the rest of the continent (M: 25.2%, W: 22.0%)
 - the impact of the lack of research funds is still perceived more negatively by men than by women



Career obstacles (II/II)

- 29.4% of female researchers (and 52.4% have children) report that balancing work and family demands have to a large extent impacted negatively on their career, whereas only 16.9% of their male colleagues (and 70.2% have children) report such a negative impact
- Women also report that they do 57.7% of the care work and general housework (compared to 37.8% for men)
 - while their partners do 20.2% of these tasks (compared to 45.1% of the partners of men)

These results clearly hint towards an important impact of family-related activities on women relative to men.



Collaboration

Lack of collaboration and mobility are often mentioned as factors that restrict women's scientific production.

How often do you collaborate with colleagues in...	Men	Women	
...own institution	3.870	3.745	***
...own country	3.169	3.079	***
...other countries in Africa	2.281	2.109	***
...other countries out of Africa	3.101	3.045	

- 38.5% of men have studied or worked abroad during the past three years, compared to 31.1% of the women
- 28.6% of men report that lack of mobility opportunities have impacted negatively on their career, compared to 21.6% of women
- Gender differences regarding how often to researchers collaborate with colleagues from their own institution, their own country and other countries in Africa are all significant in favour of men, while international collaboration is not

Regression results



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Mid-term Workshop - Paris

Regression results (I/III)

a, b, c, d significant at the
0.1%, 1%, 5%, 10% levels

propCareMe NS

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
-	dFemale	-0.1298 ^a	-0.0780 ^c	-0.0449	-0.1597 ^a	-0.2461 ^a	-0.1971 ^a	-0.2230 ^a	
		(0.0257)	(0.0365)	(0.0545)	(0.0375)	(0.0630)	(0.0461)	(0.0559)	
+	Age	0.0087 ^a	0.0087 ^a	0.0088 ^a	0.0087 ^a	0.0086 ^a	0.0086 ^a	0.0087 ^a	0.0087 ^a
		(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
+	ln(nbChildren)	0.0722 ^a	0.0929 ^a	0.0731 ^a	0.0725 ^a	0.0730 ^a	0.0731 ^a	0.0727 ^a	0.0732 ^a
		(0.0181)	(0.0206)	(0.0181)	(0.0181)	(0.0181)	(0.0181)	(0.0181)	(0.0181)
+	ln(nbWHTeaching)	0.0363 ^a	0.0363 ^a	0.0367 ^a	0.0366 ^a	0.0371 ^a	0.0369 ^a	0.0368 ^a	0.0368 ^a
		(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)
+	ln(nbWHSupervising)	0.1821 ^a	0.1817 ^a	0.1824 ^a	0.1817 ^a	0.1818 ^a	0.1822 ^a	0.1819 ^a	0.1822 ^a
		(0.0133)	(0.0133)	(0.0133)	(0.0133)	(0.0133)	(0.0133)	(0.0133)	(0.0133)
+	ln(nbWHResearch)	0.0370 ^b	0.0364 ^b	0.0369 ^b	0.0360 ^b	0.0355 ^b	0.0364 ^b	0.0362 ^b	0.0363 ^b
		(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)	(0.0129)
-	ln(nbWHAdmin)	-0.0440 ^a	-0.0450 ^a	-0.0454 ^a	-0.0445 ^a	-0.0443 ^a	-0.0445 ^a	-0.0446 ^a	-0.0445 ^a
		(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)
+	ln(nbWHService)	0.0410 ^b	0.0410 ^b	0.0406 ^b	0.0413 ^b	0.0412 ^b	0.0412 ^b	0.0410 ^b	0.0413 ^b
		(0.0139)	(0.0139)	(0.0139)	(0.0139)	(0.0139)	(0.0139)	(0.0139)	(0.0139)
-	ln(nbWHConsult)	-0.0671 ^a	-0.0673 ^a	-0.0672 ^a	-0.0670 ^a	-0.0669 ^a	-0.0671 ^a	-0.0670 ^a	-0.0669 ^a
		(0.0135)	(0.0135)	(0.0135)	(0.0135)	(0.0135)	(0.0135)	(0.0135)	(0.0135)
+	ln(nbWHFundraising)	0.0462 ^b	0.0465 ^b	0.0457 ^b	0.0461 ^b	0.0462 ^b	0.0461 ^b	0.0462 ^b	0.0455 ^b
		(0.0164)	(0.0164)	(0.0164)	(0.0164)	(0.0164)	(0.0164)	(0.0164)	(0.0164)

Regression results (II/III)

a, b, c, d significant at the
0.1%, 1%, 5%, 10% levels

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
+	ln(Funds)	0.0170 ^a	0.0171 ^a	0.0170 ^a	0.0157 ^a	0.0170 ^a	0.0169 ^a	0.0170 ^a	0.0170 ^a
		(0.0023)	(0.0023)	(0.0023)	(0.0026)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
	dMobility	0.0781 ^d	0.0247	0.0249	0.0248	0.0248	0.0242	0.0256	
		(0.0456)	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)	
+	oCollOwnInst	0.0569 ^a	0.0569 ^a	0.0570 ^a	0.0569 ^a	0.0574 ^a	0.0571 ^a	0.0568 ^a	0.0567 ^a
		(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0095)
+	oCollOwnCount	0.0652 ^a	0.0650 ^a	0.0651 ^a	0.0652 ^a	0.0535 ^a	0.0653 ^a	0.0652 ^a	0.0656 ^a
		(0.0098)	(0.0098)	(0.0098)	(0.0098)	(0.0114)	(0.0098)	(0.0098)	(0.0098)
+	oCollAfrica	0.0592 ^a	0.0487 ^a	0.0490 ^a	0.0487 ^a	0.0492 ^a	0.0402 ^a	0.0487 ^a	0.0488 ^a
		(0.0122)	(0.0096)	(0.0096)	(0.0096)	(0.0096)	(0.0108)	(0.0096)	(0.0096)
+	oCollOutAfrica	0.0275 ^b	0.0288 ^a	0.0290 ^a	0.0286 ^a	0.0286 ^a	0.0285 ^b	0.0197 ^c	0.0290 ^a
		(0.0087)	(0.0087)	(0.0087)	(0.0087)	(0.0087)	(0.0087)	(0.0099)	(0.0087)
	dHomeSA	-0.1316 ^a	-0.1302 ^a	-0.1306 ^a	-0.1304 ^a	-0.1307 ^a	-0.1294 ^a	-0.1291 ^a	-0.1269 ^a
		(0.0269)	(0.0269)	(0.0269)	(0.0269)	(0.0269)	(0.0269)	(0.0269)	(0.0269)
+	dSTEM	0.0895 ^b	0.0891 ^b	0.0919 ^a	0.0898 ^a	0.0896 ^b	0.0892 ^b	0.0888 ^b	0.0890 ^b
		(0.0272)	(0.0272)	(0.0273)	(0.0272)	(0.0272)	(0.0272)	(0.0272)	(0.0272)
	dHealth	0.2319 ^a	0.2325 ^a	0.2337 ^a	0.2315 ^a	0.2308 ^a	0.2307 ^a	0.2313 ^a	0.2327 ^a
		(0.0316)	(0.0316)	(0.0316)	(0.0316)	(0.0316)	(0.0316)	(0.0316)	(0.0316)

Regression results (III/III)

a, b, c, d significant at the
0.1%, 1%, 5%, 10% levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
- dFemaleXln(nbKids)		-0.0756 ^c (0.0374)						
- dFemaleXpropCareMe			-0.0016 ^d (0.0009)					
dFemaleXln(Funds)				0.0046 (0.0042)				
+ dFemaleXoCollOwnCount					0.0377 ^c (0.0187)			
+ dFemaleXoCollAfrica						0.0313 ^d (0.0180)		
+ dFemaleXoCollOutAfrica							0.0307 ^d (0.0165)	
dFemale_Mob								-0.0684 ^d (0.0404)
- dFemale_NoMob								-0.1637 ^a (0.0305)
dMale_Mob								-0.0032 (0.0269)



Conclusions (I/II)

- Childbearing and the ensuing care-work and housework hinders women's scientific productivity
 - does not correspond with studies conducted among various samples in the United States which found no effect, or a non-significant negative effect of marriage and/or children (including the number of children) on women's publication productivity
 - corresponds with the small but growing body of existing literature on women scientists in Africa
 - which argues that these women contend with “pro-natalist cultures” that expect them to marry and have children”
 - and that these reproductive responsibilities make it very hard for them to compete on equal terms with men
 - especially because of a traditional gendered division of labour within households



Conclusions (II/II)

- Childbearing and the ensuing care-work and housework also has an indirect effect on mobility and collaboration, which we found offsets the effect of gender on publication productivity
 - many women scientists are limited in their geographic mobility by family demands
 - In Africa, female researchers reported difficulties travelling to conferences, for example, because of the assumption that they are the primary domestic caregiver at home, thereby restricting their professional networks and collaboration opportunities
- As long as scientific production is measured and rewarded in ways that ignore these gender differences, and research institutions are organised on the basis of the assumption that academics have wives that attend to obligations of family and household, women scientists in Africa will continue to be judged and treated as the “less productive” gender



Thank you

QUESTIONS?

