

An Update: Are Women Getting All the Jobs?

Mary E. Flahive and Marie A. Vitulli

In the 1990s some mathematicians questioned whether affirmative action efforts were skewing the job market in favor of women. With this in mind, twelve years ago we analyzed the 1991–1995 employment data collected by the AMS for possible gender bias in the employment of new Ph.D. mathematicians. A summary of our analysis appeared in [1], where we reported that the data showed that women were *not* getting more than their share of first jobs, but that there were gender differences in the *type* of employment. In the current article we summarize what has happened in the intervening years. We thank Jim Maxwell of the AMS for supplying the data collected from the AMS-ASA-IMS-MAA-SIAM Annual Surveys (<http://www.ams.org/employment/survey.html>), and Virginia Lesser, Department of Statistics, Oregon State University, for helpful discussions concerning the statistical framework of this article.

Each year the AMS conducts a census of new Ph.D.s by sending surveys to all departments that grant doctoral degrees in mathematics. The data are grouped by the AMS according to type of doctorate-granting department: Group I consists of the top 48 U.S. mathematics departments;¹ Group II contains the next 56 departments; Group III contains the remaining U.S. departments reporting a doctoral program in mathematics; Group IV contains U.S. departments (or programs)

Mary E. Flahive is associate professor of mathematics at Oregon State University. Her email address is flahive@math.oregonstate.edu.

Marie A. Vitulli is professor of mathematics at the University of Oregon. Her email address is vitulli@uoregon.edu.

¹The ranking is based on the 1995 report *Research-Doctorate Programs in the United States: Continuity and Change*, published by National Academy Press.

of statistics, biostatistics, and biometrics reporting a doctoral program; and Group Va consists of all U.S. departments (or programs) in applied mathematics/applied science reporting a doctoral program. Group IV is not considered in this report.

The response rate for all groups treated in this report has been on average at least 96% since 2002.² Despite the high overall response rate, over the past few years an increasing number of departments have sent the AMS only basic information on their new Ph.D.s and have often omitted data on employment status. The number of unknowns would be even higher but for Web searches by the AMS that secured additional employment information, especially for those in academia. This is among the reasons why the AMS conjectures new Ph.D.s who are categorized as Unknowns are skewed toward new Ph.D.s in non-academic employment and individuals who may no longer be in the U.S. The survey data also neither distinguish between one-year and multi-year jobs nor identify tenure-stream positions.

In this note we return to three questions raised in our original investigation:

- Do men and women have the same employment rates?
- Are there gender differences in the type of employment?
- With regard to academic jobs in Groups I, II, III, Va, are men and women equally successful in obtaining positions in departments whose ranking is at least comparable to the degree-granting department?

Although our current analysis is similar to the earlier one, there are some differences. In

²Our data as well as all response rates come from the *Second Reports of the Annual Surveys from 2001 on*. Prior to 2001 only the data from the *First Reports* were available.

Table 1a. Observed Frequencies of First Jobs (Percentages of Column Totals) for Groups I-III Ph.D.s

Employer Type	1991-1995			1996-2008		
	Female	Male	Totals	Female	Male	Totals
Group Ia	108 (15.4%)	491 (19.6%)	597 (18.7%)	399 (18.1%)	1466 (22.4%)	1865 (21.3%)
Group II	34 (4.9%)	149 (5.9%)	183 (5.7%)	180 (8.2%)	552 (8.4%)	732 (8.4%)
Group III	65 (9.4%)	183 (7.3%)	248 (7.8%)	123 (5.6%)	229 (3.5%)	352 (4.0%)
Master's	82 (11.9%)	235 (9.4%)	317 (9.9%)	238 (10.8%)	467 (7.1%)	705 (8.1%)
Bachelor's	185 (26.9%)	422 (16.8%)	607 (19.0%)	489 (22.2%)	987 (15.1%)	1476 (16.9%)
Other Academic	155 (22.5%)	652 (26.0%)	807 (25.2%)	456 (20.7%)	1557 (23.8%)	2013 (23.0%)
Non-Academic	62 (9.0%)	379 (15.1%)	441 (13.8%)	317 (14.4%)	1277 (19.5%)	1594 (18.2%)
Totals	689 (100%)	2511 (100%)	3200 (100%)	2202 (100%)	6535 (100%)	8737 (100%)

the current study the data on new Ph.D.s from Group Va departments are included. Also, over the years there has been some change in the recording of data, principally the 1996 change in the groupings of doctorate-granting institutions already discussed. Finally, in Table 2 we report comparable employment percentages for all new Ph.D.s rather than for U.S. citizens only.

Do Men and Women Have the Same Employment Rates? As in the original study, we calculate a jobless rate; that is, the rate of unemployment based only on those individuals whose employment status is known.

Looking only at Groups I-III, each of our studies found no substantial gender difference in rates: for 1991-95 the jobless rate for women was 10.2% and for men was 12.0%; for 1996-2008 the jobless rates were 6.0% (women) and 5.2% (men). When Group Va is included, the 1996-2008 jobless rates decrease to 5.3% for women and 4.6% for men.

There were two anomalous years. In 2001 there was a significant difference in jobless rates by gender: 9.0% (women) and 4.1% (men). During the early 2000s there were a substantial number of NSF-sponsored postdocs including those from the VIGRE program. We wonder if there was a noticeable gender difference in these awards that contributed to the difference in jobless rates. The second year was 2008 when the jobless rates were considerably higher for both genders: 10.3% (women) and 11.9% (men).

Are There Gender Differences in the Type of Employment? (Refer to Tables 1a and 1b.) In order to analyze similar employment, we have combined several AMS categories of employers. For us, Other Academic employers combines the AMS categories of Groups IV, Va, Two-Year Colleges, Other Academic and Non-U.S. Academic employers; our Non-Academic refers to the three AMS categories of Government, Business and Industry, and Non-U.S. Non-Academic. In addition, we include research institutes with Group I academic institutions, collectively referring to them to as Group Ia. For Groups I-III (refer to Table 1a)

there continues to be a marked gender difference in the employment rates with three employer types: Group Ia, Non-Academic, and Bachelor's. There is a higher percentage of employment of men both in Group Ia (18.1% female vs. 22.4% male) and in Non-Academic employers (14.4% female; 19.5% male). On the other hand, the first jobs for 22.2% of the women and 15.1% of the men are at four-year colleges. This difference in type of position translates into less opportunity for women to continue their mathematical research as well as a possible gender-biased salary disparity. As an aside, we note that the total employment for the groups Ia, II, and Non-Academic has increased in the last decade. During 1996-2008, 25.2% of the Groups I-III Ph.D.s were women.

For our analysis of the Group Va cohort (refer to Table 1b), the AMS groups IV and Va have been added as separate employer types and therefore deleted from Other Academic category. Table 1b indicates there is less gender difference in employment rates for new Ph.D.s from Group Va programs. There is still a gender difference for first jobs at four-year colleges (7.5% female vs. 3.7% male) and Non-Academic jobs (33.5% female and 39.2% male). In addition we observe a gender difference for Other Academic jobs (32.7% female; 26.4% male). During 1996-2008, 24.5% of the Group Va Ph.D.s were women.

With Regard to Academic Jobs, Are Men and Women Equally Successful in obtaining positions in departments whose ranking is at least comparable to the degree-granting department? (Refer to Table 2.)³ As noted earlier, since the data collected from departments do not give detailed information on the type of position, a definitive answer to this question is not possible. Given that caution, the information in Table 2 again indicates that women are slightly less successful in obtaining positions

³For Group I Ph.D.s we calculated the percentage who obtained jobs at Group Ia departments; for Group II Ph.D.s we calculated the percentage who obtained jobs at Group Ia-II departments; and for Group III Ph.D.s we calculated the percentage who obtained jobs at Group Ia-V departments.

Table 1b. Observed Frequencies of First Jobs (Percentages of Column Totals) for Group Va Ph.D.s 1996–2008

Employer Type	Female	Male	Totals
Group Ia	27 (10.6%)	96 (12.3%)	123 (11.9%)
Group II	7 (2.8%)	21 (2.7%)	28 (2.7%)
Group III	1 (0.4%)	13 (1.7%)	14 (1.4%)
Group IV	3 (1.2%)	9 (1.2%)	12 (1.2%)
Group Va	23 (9.1%)	79 (10.1%)	102 (9.9%)
Master's	6 (2.4%)	22 (2.8%)	28 (2.7%)
Bachelor's	19 (7.5%)	29 (3.7%)	48 (4.6%)
Other Academic	83 (32.7%)	206 (26.4%)	289 (27.9%)
Non-Academic	85 (33.5%)	306 (39.2%)	391 (37.8%)
Totals	254 (100%)	781 (100%)	1035 (100%)

Table 2. Comparable Employment Rates for New Groups I–III Ph.D.s

Ph.D. Granting Institution											
1991–1995			1996–2008								
Group I		Group II		Group III		Group I		Group II		Group III	
F	M	F	M	F	M	F	M	F	M	F	M
27.1%	31.0%	11.3%	17.4%	20.6%	17.7%	30.9%	33.7%	20.2%	19.8%	18.7%	19.2%

comparable with their training. We have included data summarizing our earlier findings, and note that the success rates for both females and males from Group II institutions have improved over the past decade, particularly for women. Group I continues to have the most success in obtaining employment comparable to their training.

For Ph.D.s from Group Va departments, we considered comparable academic employment to be jobs in either Group Ia or Group Va departments. Under this definition, Ph.D.s from Group Va have comparable employment rates of 19.7% for women and 22.4% for men, again slightly more favorable for men.

In summary, our analysis shows that, over the past two decades, men and women have been about equally successful in obtaining first jobs but there continue to be marked gender differences in the type of first jobs. We encourage all doctoral departments and programs to help minimize the number of Unknowns by supplying as much information about their recent Ph.D.s as possible.

References

- [1] MARIE A. VITULLI and MARY E. FLAHOVE, Are women getting all the jobs?, *Notices of the AMS* 44 (1997), 338–339.