

# Employment Experiences of 1990–1991 U.S. Institution Doctoral Recipients in the Mathematical Sciences

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**T**his report describes the employment experience over a two- to-three-year period of individuals who received a doctorate in the mathematical sciences from a U.S. institution between July 1, 1990, and June 30, 1991. Results of the 1993 AMS-IMS-MAA Employment Profile Survey are analyzed and presented. This special survey collected information about employment histories for a sample of the target population over the period from the receipt of their degrees to fall 1993.

In 1990–1991, a total of 1,125 doctorates were awarded by mathematics, statistics, applied mathematics, and operations research departments in the U.S. In November 1991, the First Report of the 1991 Annual AMS-MAA Survey [1] reported an alarming 12 percent of this population to be unemployed and seeking employment. This percentage was over twice the rate of unemployment reported the year before for 1989–1990 degree recipients and was the highest rate reported in the fall since 1975. In the follow-up report on the 1991 Annual Survey in spring 1992 [2], the unemployment rate for 1990–1991 doctoral recipients was 5 percent; the rate reported in the spring had never exceeded 3 percent since the follow-up analyses were first reported in 1977.

The 1990–1991 doctoral recipients confronted a shock wave in the employment market, caused by three major forces coming together at one time. As documented in the 1991–1992 Academic Hiring Survey of the AMS Task Force on Employment [5] and in Annual Surveys [2,3,4], the

employment market was severely affected by an increased number of new Ph.D.s, by drastically reduced levels of recruitment attributed to economic conditions, and by increased numbers of highly qualified recent U.S. immigrants seeking employment in the market for mathematical scientists.

There has been widespread concern in the mathematics community about the longer-term effects of the difficult market on employment of recent Ph.D.s. In spring 1993, the AMS-IMS-MAA Data Committee designed the Employment Profile Survey to learn more about these effects. The 1990–1991 doctoral recipients were chosen as the focus of the study, since they were the first group that was especially hard-hit by the declining job market.

The three factors causing the difficult market in 1991 persisted through 1992 and 1993. Not only did the 1990–1991 doctoral recipients face a difficult market when seeking their first jobs, but the factors that caused an initial imbalance between supply and demand remained in force during the subsequent two-year period when many of the 1990–1991 cohort were seeking more permanent situations than their first jobs.

The 1,125 doctorates awarded in 1990–1991 represented an 18 percent increase from the number awarded in 1989–1990. At that time, it was the highest count of new degrees reported

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since 1971–1972. The numbers of degrees awarded in 1991–1992 and 1992–1993 sustained the high level of 1990–1991, totaling 2,276 degrees over the two-year period.

There was at the same time a precipitous drop in levels of recruitment by academic employers during 1990–1991 and further declines in 1991 to 1993. As reported in the Second Reports of the 1991, 1992, and 1993 Annual Surveys [2,3,4], the number of doctoral faculty positions which departments sought to fill in 1990–1991 was 17 percent lower than the number in 1989–1990 for the doctorate-granting mathematics departments (Survey Groups I, II, and III), 34 percent lower for masters-granting mathematics departments (Group M), 18 percent lower for bachelors-granting mathematics departments (Group B), and 33 percent lower for doctorate-granting statistics departments (Group IV). Over the three-year period, 1990–1991 through 1992–1993, the number of doctoral-level faculty positions that departments sought to fill declined 22 percent in Groups I, II, and III combined; 45 percent in Group M; 30 percent in Group B; and 37 percent in Group IV. There were simply fewer jobs.

Quantitative information about the effects on the employment market of highly trained recent U.S. immigrants is rather sketchy and difficult to measure. The 1991–1992 Academic Hiring Survey [5] was able to gauge part of the effect on academic positions filled in doctorate-granting mathematics departments during 1990–1991. Thirteen percent of all positions filled for 1991–1992 and 15 percent of the tenured or tenure-eligible positions filled were held by citizens of Eastern Europe and the former Soviet Union. The National Science Foundation recently reported a large increase in 1992 for the number of highly trained scientists and engineers receiving permanent resident status in the U.S., including substantial numbers of new permanent residents in the mathematical and computer sciences [6]. Many of these individuals are seeking positions appropriate for their skills and education and are having a substantial effect on the overall supply of mathematical scientists.

It is in this context that particular concern has been felt for the employment prospects of the 1990–1991 and other recent doctoral recipients. The Data Committee focused their attention for the special survey on the subpopulation whose employment or known address in the 1991 Annual Survey was in the U.S. There are 921 doctoral recipients in this group. Based on the final results of the 1991 Annual Survey, the employment matrix of the 921 doctoral recipients on the U.S. employment market in fall 1991 is given in Table 1. The data in Table 1 represents a com-

## Highlights

- U.S. institutions awarded 1,125 doctorates in the mathematical sciences between July 1, 1990, and June 30, 1991. In fall 1991, 921 of these degree recipients held employment or had a known address in the U.S.
- By fall 1993, an estimated 856 of the 1990–1991 doctoral recipients remained in the U.S., and an estimated 65 had moved to a position or address outside the U.S. Among those in the U.S. whose employment status was known, an estimated 11 percent had not secured a position for fall 1993 as of spring/summer 1993.
- In the first fall after receiving their doctorates, an estimated 79 percent of the 816 individuals employed in the U.S. were in academic positions. In fall 1993, an estimated 76 percent of those with known employment in the U.S. were in academic positions.
- Among the 921 doctoral recipients in the U.S. in fall 1991, an estimated 401 were not in the same position in fall 1993 that they held in the first fall after receipt of their doctorates. An estimated 150 individuals moved out of U.S. academic positions, and an estimated 24 individuals moved from outside academia into U.S. academic positions.
- In the first fall after receipt of their doctorates, an estimated 54 percent of the group who held U.S. academic positions were in tenure-track positions. In fall 1993, an estimated 76 percent of the U.S. academic positions held by the 1990–1991 doctoral recipients were tenure-track positions. The number of positions held by this group and known to be tenure-track increased from an estimated 304 in the first fall after receipt of their doctorate to 357 in fall 1993.

plete census of the 1990–1991 doctoral recipients on the U.S. employment market. It is based on information provided first by the doctorate-granting departments and confirmed by a follow-up survey of the individuals themselves.

## Employment Profile Survey

The main questions addressed in the 1993 Employment Profile Survey relate to the employment histories of the target population of 921 individuals. Very good baseline information was available from the 1991 Annual Survey. Since the majority of new doctoral recipients traditionally enter the academic job market, special attention was directed to that sector of the market. Based on 1991 data, it was estimated that around 300 individuals held non-tenure-eligible positions in fall 1991; this subgroup was presumed to be actively seeking longer-term, career positions at some point in the early years after receipt of their degrees. The survey was designed to assure that meaningful estimates of employment patterns could be determined for the population as a whole and for the subpopulation who held temporary positions in 1991.

A random sample of 365 individuals, 40 percent of the population, was selected from the tar-

## Classifications

The 1993 Employment Profile Survey is under the direction of the AMS-IMS-MAA Data Committee, whose members are Paul W. Davis, Lorraine Denby, John D. Fulton (chair), James Hurley, Don O. Loftsgaarden, James W. Maxwell (ex officio), Donald B. Rubin, Donald C. Rung, Ann K. Stehney, and Ann E. Watkins. Comments or suggestions regarding this Survey may be directed to the committee.

For these reports, departments are divided into groups according to the highest degree offered in the mathematical sciences:

**Groups I and II** include the leading departments of mathematics in the U.S. according to the 1982 Assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils, in which departments were rated according to the quality of their graduate faculty.<sup>1</sup>

**Group I** is composed of 39 departments with scores in the 3.0–5.0 range.

**Group II** is composed of 43 departments with scores in the 2.0–2.9 range.

**Group III** contains the remaining U.S. departments reporting a doctoral program.

**Group IV** contains U.S. departments (or programs) of statistics, biostatistics, and biometrics reporting a doctoral program.

**Group V** contains U.S. departments (or programs) in applied mathematics/applied science, operations research, and management science which report a doctoral program.

**Group Va** is applied mathematics/applied science.

**Group Vb** is operations research and management science.

**Group M** contains U.S. departments granting a master's degree as the highest graduate degree.

**Group B** contains U.S. departments granting a baccalaureate degree only.

<sup>1</sup> These findings were published in *An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences*, edited by Lyle V. Jones, Gardner Lindzey, and Porter E. Coggeshall; National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics, and computer science was presented in digest form in the April 1983 issue of the Notices, pages 257–267, and an analysis of the above classifications was given in the June 1983 Notices pages 392–393. For a listing of departments in Groups I and II see the April 1988 Notices, pages 532–533.

get population. The sample size and the sample design were chosen to control the sampling variability of the estimates of key proportions and subpopulation characteristics of interest. In particular, the sample was stratified in order to reduce variability of estimates and to assure proportionate representation in the sample of individual characteristics of interest: sex, citizenship status, Group of the degree-granting department, and category of employment in fall 1991.

Data were collected from the 365 individuals in the sample starting in spring 1993. Most of the data collection effort was completed by August 1993. However, the process of doing thor-

ough follow-up and of validating responses extended in a few cases until April 1994. There was special attention to having as complete a response as possible from individuals in the sample whose fall 1991 employment was in the academic sector.

There is sampling variability in the following tables that describe various patterns of employment. For the sample size used, the standard deviation of an estimate of a proportion for the population as a whole is 2 percent. For example, when the proportion of the population employed in a Group B department in fall 1993 is estimated (Table 4A), that estimate is the value of a random variable with standard deviation .02; the true proportion for the population is 95 percent certain to be within .04, two standard deviations, of the estimate. When we focus on the subpopulation of 264 individuals who held a non-tenure-eligible position in the first fall after receiving their doctorate (Table 5A and Table 7), the standard deviation of the estimate of a proportion is 3.5 percent.

The response rates for the sample of 365 as a whole and for various subsamples of interests are shown in Table 2. Out of 263 sampled individuals whose type of employment in fall 1991 was in academia or a research institute, 258 or 98 percent either responded to the survey directly or information about their employment status was confirmed by other cognizant individuals.

The estimated tallies in the tables that follow are derived by scaling and adding proportions estimated within population strata. The final values are rounded floating-point values. As a result of rounding, it may appear that row and column subtotals of rounded values are not exactly right. This is merely an effect of intermediate rounding.

## Employment History

Employment status is estimated for the target population at two points in time: the first fall after each individual received his or her doctorate, referred to as “Fall I,” and fall 1993.

Tables 3A and 3B report estimated employment status in Fall I (the first fall after receipt of doctorate). The patterns reflected here are slightly different from those shown in Table 1 for fall 1991. Indeed, for a number of individuals in the population, Fall I was actually fall 1990; 261 members of the population, 28 percent, received their degrees in July, August, or September of 1990.

The vigilant reader may observe apparent inconsistencies between Tables 3A and 3B and similarly for Tables 4A and 4B. For example, Table 3A estimates that 122 individuals from the whole population were employed in Business

**Table 1: Fall 1991 Employment Status of 1990–1991 Doctoral Recipients in the Mathematical Sciences by Type of Granting Department**  
(Includes only those whose position or known address in fall 1991 was in the U.S.)

TYPE OF EMPLOYER	TYPE OF DOCTORAL DEGREE-GRANTING DEPARTMENT					ROW TOTAL	ROW SUBTOTALS	
	Group I Math	Group II Math	Group III Math	Group IV Statistics	Group V Applied Math/OR		Male	Female
Group I	99	7	1	1	5	113	98	15
Group II	24	13	3	1	8	49	37	12
Group III	35	9	15	7	1	67	56	11
Group IV	0	2	3	36	2	43	33	10
Group V	1	3	1	1	18	24	20	4
Masters	29	28	24	15	5	101	80	21
Bachelors	44	40	45	4	9	142	99	43
Two-Year Colleges	8	5	10	1	1	25	21	4
Other Academic Depts.	21	6	3	15	23	68	47	21
Research Institutes	15	2	1	9	6	33	28	5
Government	8	4	3	7	11	33	28	5
Business and Industry	22	17	17	38	44	138	111	27
Foreign, Academic						0	0	0
Foreign, Nonacademic						0	0	0
Not Seeking Employment	6	7	3	3	0	19	14	5
Still Seeking Employment	12	12	7	8	6	45	38	7
Unknown (U.S.)	12	2	1	0	6	21	16	5
Unknown (non-U.S.)*						0	0	0
Column Total	336	157	137	146	145	921	726	195
Column Subtotals	Male	277	121	110	105	113	726	
	Female	59	36	27	41	32	195	

\*Non-U.S. citizens who returned to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Source: 1991 Annual AMS-MAA Survey (26 February 1992)

and Industry, while Table 3B estimates that 123 individuals from a subset of the population were employed in Business and Industry. Such discrepancies occur because the table entries are estimates based on a random sample and because slightly different strata were used for constructing the two tables; strata based on sex were used in forming Table 3A and strata based on citizenship status were used for Table 3B. Counts and percentages cited immediately below refer to Table 3A, unless otherwise noted. Percentages cited are among those whose employment status is known.

Of the 816 doctoral recipients employed in the U.S. in Fall I, a total of 644 (79 percent) held academic employment. The 644 academic positions include a total of 274 in doctorate-granting departments, 36 percent of total U.S. employment. As has been documented in previous Annual Survey reports, there are still signs of serious "underemployment" hidden beneath these raw counts. Underemployment is reflected in part-time positions and in numbers of individuals holding employment in the same department that awarded their degree. In the 1991 Annual Survey, for example, 45 individuals reported holding a position in the department that awarded their degree.

Among those whose employment status in Fall I is known, 63 individuals (7.1 percent) were unemployed. By contrast, in the final analysis of the fall 1990 employment status of 1989–90 doctoral recipients, only 2 percent were unemployed.

Table 3A shows differential employment patterns in Fall I depending on the type of degree earned and on sex. In particular, 88 percent of those people whose employer in Fall I was a Group I department earned their degrees from a Group I department, and 89 percent of the Group IV hires in Fall I were awarded their doctorates by a Group IV department. Group IV and Group V degree recipients were much more likely to have held employment in Business and Industry; 57 percent of the individuals who held employment in Business and Industry were from Group IV or V departments, while only 31 percent of the degrees awarded were from these two Groups. No unemployment at all is estimated among Group IV degree recipients, while 8.9 percent of recipients of mathematics degrees are estimated to have been unemployed in Fall I.

There are interesting differences in type of employment for men and women reported in Table 3A. Though there is no apparent difference in proportions holding jobs in doctorate-granting departments (29 percent of the women and

**Table 2: Subpopulation Sizes, Target Sample Sizes, and Survey Response Rates for 1990–1991 Doctoral Recipients in the Mathematical Sciences Whose Employer or Known Address in Fall 1991 Was in the U.S.**

Description	Population Size	Target Sample Size	Number of Respondents	Response Rate
<b>Full Population</b>				
1990–91 Ph.D.s with Fall 1991 Employment in the U.S.	921	365	301	82%
<b>Subpopulation by Type of Fall 1991 Employer</b>				
Doctorate-Granting Department	296	117	115	98%
Academic Department, Nondoctorate-Granting	336	132	131	99%
Research Institute	33	14	12	86%
U.S. Nonacademic	171	68	26	38%
Unemployed or Unknown Status	85	34	17	50%
<b>Subpopulation by Sex</b>				
Male	726	286	233	81%
Female	195	79	68	86%
<b>Subpopulation by Citizenship Status</b>				
U.S. Citizen	462	187	161	86%
Non-U.S. Citizen	432	168	132	79%
Unknown Status	27	10	8	80%

Source: 1993 AMS-IMS-MAA Employment Profile Survey (April 1994)

31 percent of the men), there are much greater differences in proportions holding jobs in bachelors-granting departments: an estimated 12 percent of the men and 26 percent of the women held Group B employment in Fall I. Nonacademic jobs were held by 20 percent of the men and 16 percent of the women.

Table 3B shows the Fall I employment as it depends on citizenship status. Citizenship status is known for 894 members of the target population. Non-U.S. citizens who remained in the U.S. are more likely than U.S. citizens to have had a position in a doctorate-granting department. Among non-U.S. citizens, 40 percent held a position in a Group I-V department, and 23 percent of U.S. citizens held a position in a Group I-V department. In contrast, U.S. citizens held jobs in bachelors-granting departments in higher proportion than non-U.S. citizens. Among U.S. citizens, 21 percent held a position in a Group B department, while 8 percent of non-U.S. citizens held a position in a Group B department.

Tables 4A and 4B report estimated employment plans for fall 1993. Three points should be

noted concerning the interpretation of results shown in these tables.

First, most of the survey data were collected before fall 1993, when a significant number of respondents were still on the open job market and may not yet have determined their employment for fall 1993. The responses indicate the plans as best they were known when each respondent provided the requested information. Thus, the reported “unemployment” is almost certainly higher than the actual unemployment later turned out to be in fall 1993.

Second, the employment status “Unknown Status” has multiple interpretations. It may indicate that the doctoral recipient truly did not know his or her plans for fall 1993. It may mean that the information was provided to the Data Committee by an individual other than the respondent per se, for example, by a department staff member, and that the individual providing the information did not know the doctoral recipient’s plans even though the recipient did.

Third, because of the different response rates for academic vs. nonacademic strata in the sam-



**Table 3A: Estimated Employment Status in First Fall after Receipt of Doctorate**  
of 1990–1991 Doctoral Recipients in the Mathematical Sciences by Type of Granting Department  
(Includes only those whose position or known address in fall 1991 was in the U.S.)

(5 March 1995) Type of Employer First Fall after Doctorate	Type of Doctoral Degree-Granting Department					Row Total	Row Subtotals	
	Group I Math	Group II Math	Group III Math	Group IV Statistics	Group V Applied Math/OR		Male	Female
Group I	82	7			4	93	77	15
Group II	23	10	5		11	50	43	7
Group III	31	13	12	12		68	49	19
Group IV			5	41		46	38	8
Group V				8	9	17	10	7
Masters	25	32	27	6		90	72	18
Bachelors	38	29	54	6	9	136	86	50
Two-Year Colleges	11	12	9			32	30	2
Other Academic Depts.	11	10	7	29	27	84	64	20
Research Institutes	14				14	28	28	0
Government	13	3		16	18	50	36	15
Business and Industry	31	7	13	28	42	122	107	15
Foreign, Academic	5					5	5	0
Foreign, Nonacademic						0	0	0
Not Seeking Employment		7				7	7	0
Still Seeking Employment	35	16	5		7	63	47	17
Unknown (U.S.)	16	5			4	25	20	5
Unknown (non-U.S.)*		5				5	5	0
Column Total	336	157	137	146	145	921	726	195
Column Subtotals	Male	277	121	110	105	113	726	
	Female	59	36	27	41	32	195	

\*Non-U.S. citizens who returned to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

**Table 3B: Estimated Employment Status in First Fall after Receipt of Doctorate**  
of 1990–1991 Doctoral Recipients in the Mathematical Sciences by Citizenship Status  
(Includes only those whose position or known address in fall 1991 was in the U.S.)

(4 March 1995) Type of Employer First Fall after Doctorate	Type of Citizenship				Total Doctoral Recipients Whose Citizenship is Known	
	U.S. Citizens		Non-U.S. Citizens		Number	Percent*
	Number	Percent*	Number	Percent*		
Group I	30	7	60	14	90	10
Group II	22	5	27	6	49	6
Group III	24	5	44	10	68	8
Group IV	17	4	34	8	51	6
Group V	11	2	7	2	17	2
Masters	51	11	39	9	90	10
Bachelors	96	21	33	8	129	15
Two-Year Colleges	20	4	13	3	33	4
Other Academic Depts.	39	9	44	10	84	10
Research Institutes	11	2	12	3	23	3
Government	36	8	9	2	45	5
Business and Industry	55	12	67	16	123	14
Foreign, Academic	5	1	0		5	1
Foreign, Nonacademic	0		0		0	
Not Seeking Employment	0		8	2	8	1
Still Seeking Employment	32	7	30	7	63	7
Unknown (U.S.)	13		0		13	
Unknown (non-U.S.)*	0		5		5	
Column Total	462	100%**	432	100%**	894	100%**

\* Percentage of those whose employment status is known.

\*\* Column percents are rounded to the nearest whole percent.

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

**Table 4A: Estimated Fall 1993 Employment Plans**  
of 1990-1991 Doctoral Recipients in the Mathematical Sciences by Type of Granting Department  
(Includes only those whose position or known address in fall 1991 was in the U.S.)

(5 March 1995)		Type of Doctoral Degree-Granting Department					Row Total	Row Subtotals	
Type of Employer Fall 1993	Group I Math	Group II Math	Group III Math	Group IV Statistics	Group V Applied Math/OR	Male		Female	
Group I	55	3				57	46	11	
Group II	7	2			4	12	10	2	
Group III	33	9	8	18	4	71	45	26	
Group IV	6			32		39	31	8	
Group V	2			6	6	14	12	2	
Masters	35	28	24	8		94	74	21	
Bachelors	42	35	52	11	10	149	87	62	
Two-Year Colleges	18	10	7			35	30	5	
Other Academic Depts.	12	5	2	17	10	47	27	19	
Research Institutes					6	6	4	2	
Government	6			9	10	25	25	0	
Business and Industry	31	22	13	31	39	137	122	15	
Foreign, Academic	7	5			4	16	16	0	
Foreign, Nonacademic	5					5	5	0	
Not Seeking Employment	7					7	7	0	
Still Seeking Employment	28	15	19	3	21	86	75	11	
Unknown (U.S.)	23	15	9	6	25	79	68	10	
Unknown (non-U.S.)*	19	10	2	6	7	44	42	2	
Column Total	336	157	137	146	145	921	726	195	
Column Subtotals	Male	277	121	110	105	113	726		
	Female	59	36	27	41	32	195		

\*Non-U.S. citizens who returned to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

**Table 4B: Estimated Employment Status in Fall 1993**  
of 1990-1991 Doctoral Recipients in the Mathematical Sciences by Citizenship Status  
(Includes only those whose position or known address in fall 1991 was in the U.S.)

(4 March 1995)		Type of Citizenship				Total Doctoral Recipients Whose Citizenship is Known	
Type of Employer Fall 1993	U.S. Citizens		Non-U.S. Citizens		Number	Percent*	
	Number	Percent*	Number	Percent*			
Group I	32	7	24	7	55	7	
Group II	5	1	8	2	13	2	
Group III	31	7	41	11	72	9	
Group IV	18	4	22	6	39	5	
Group V	8	2	7	2	15	2	
Masters	43	10	50	14	93	12	
Bachelors	103	24	26	7	129	17	
Two-Year Colleges	24	6	10	3	34	4	
Other Academic Depts.	22	5	16	5	39	5	
Research Institutes	3	1	3	1	6	1	
Government	27	6	9	2	35	5	
Business and Industry	56	13	86	24	142	18	
Foreign, Academic	3	1	12	3	15	2	
Foreign, Nonacademic	0		5	1	5	1	
Not Seeking Employment	0		8	2	8	1	
Still Seeking Employment	48	11	33	9	82	10	
Unknown (U.S.)	40		33		72		
Unknown (non-U.S.)*	0		39		39		
Column Total	462	100%**	432	100%**	894	100%**	

\*Percentage of those whose employment status is known.

\*\* Column percents are rounded to the nearest whole percent.

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

**Table 5: Estimated Flow Between Types of Employment from First Fall after Doctorate to Fall 1993** for 1990–1991 Doctoral Recipients in the Mathematical Sciences Whose Employment or Known Address in Fall 1991 Was in the U.S.

*(This table reports type of employment in first fall after receipt of doctorate vs. type of employment planned for fall 1993 for only those individuals in the population who had any change in employment in the intervening period.)*

Type of Employment, First Fall after Doctorate	Type of Employment, Fall 1993							Row Total	Net Outflow
	Academic, Doctorate- Granting Dept., or Research Institute	Academic, Non- Doctorate- Granting	Govt., Business and Industry	Employed Outside U.S.	Not Employed, U.S. Address	Unknown Status, U.S. Address	Unknown Status, Foreign Address		
Academic, Doctorate- Granting Department, or Research Institute	65	30	3	10	32	21	16	176	101
Academic, Non- Doctorate-Granting	8	28	3	3	23	28	13	105	27
Govt., Business and Industry		3	13		3	7		25	-10
Employed Outside U.S.	3					3		5	-10
Not Employed, U.S. Address		10	14	3	35	8	5	75	-18
Unknown Status, U.S. Address		8	3				5	15	-51
Unknown Status, Foreign Address								0	-38
Column Total	75	78	35	15	93	66	38	401	0
Net Inflow	-101	-27	10	10	18	51	38	0	

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

ple, some “selection biases” may affect the results in Tables 4A and 4B. We believe these effects are small, since the overall response rate is high. For example, because it was much more difficult to do thorough follow-up with individuals holding nonacademic employment, it may be that the estimate of numbers holding nonacademic employment in fall 1993 is negatively biased and counts of those in the “Unknown Status, U.S.” category are correspondingly inflated.

Counts and percentages reported immediately below refer to Table 4A unless otherwise noted. Percentages cited are among those whose employment status is known.

Of the 686 doctoral recipients employed in the U.S. in fall 1993, a total of 524 (76 percent) expected to hold academic employment. The 524 academic positions include a total of 193 in doctorate-granting departments, 37 percent of total U.S. employment.

Among those whose employment plans for fall 1993 were known, 86 individuals (10.8 percent) were unemployed.

Table 4A shows differential employment patterns in fall 1993 depending on the type of degree earned and on sex. In particular, 83 percent of those people whose employer in fall 1993 was a doctorate-granting mathematics department, Groups I-III, earned their degrees from a Group I department. The proportion among those with plans to be employed in Business and Industry in the U.S. who held a mathematics doctorate (Groups I-III) increased to 48 percent. The unemployment rate estimated among Group IV degree recipients was still extremely low at 2 percent, while 11 percent of recipients of mathematics degrees are estimated to have been unemployed at this stage of their planning for fall 1993.

The differences in employment patterns seen in Fall I for men and women are still shown in the plans for fall 1993. The difference between proportions planning to hold a position in a doctorate-granting department is not significant (23 percent of the men and 27 percent of the women). There were much greater differ-



**Table 6A: Estimated Tenure Status in First Fall after Receipt of Doctorate**  
of 1990–1991 Doctoral Recipients in the Mathematical Sciences  
*(Includes only those whose position or known address in fall 1991 was in the U.S.)*

	Type of Employer in First Fall after Receipt of Doctorate											Total
	Group I	Group II	Group III	Group I+II+III	Group IV	Group V	Group M	Group B	2-Year College	Other Acad.	Foreign Acad.	
Number in Tenure-Track Positions	5	10	46	62	21	5	72	105	17	23	0	304
Number in Non-Tenure-Eligible Positions	90	36	10	136	18	12	15	18	13	46	5	264
Unknown Tenure Status	5	8	10	23	3	0	8	8	0	10	0	51
Total Number of Positions	100	54	67	221	41	17	95	131	30	79	5	619
Percent* Tenure-Track	5%	22%	82%	31%	53%	30%	82%	85%	57%	33%	0%	54%

\* Percentage of those whose tenure status is known.

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

**Table 6B: Estimated Tenure Status in Fall 1993**  
of 1990–1991 Doctoral Recipients in the Mathematical Sciences  
*(Includes only those whose position or known address in fall 1991 was in the U.S.)*

	Type of Employer in Fall 1993											Total
	Group I	Group II	Group III	Group I+II+III	Group IV	Group V	Group M	Group B	2-Year College	Other Acad.	Foreign Acad.	
Number in Tenure-Track Positions	8	13	57	77	18	8	89	118	22	23	3	357
Number in Non-Tenure-Eligible Positions	49	0	5	54	5	5	3	13	10	16	5	111
Unknown Tenure Status	5	3	8	15	12	0	10	3	5	10	8	63
Total Number of Positions	62	15	69	147	35	13	101	133	37	49	15	531
Percent* Tenure-Track	14%	100%	92%	59%	78%	60%	97%	90%	68%	60%	33%	76%

\* Percentage of those whose tenure status is known.

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

ences in proportions holding jobs in bachelors-granting departments: an estimated 14 percent of the men and 34 percent of the women planned to hold Group B employment in fall 1993. Nonacademic jobs were expected to be held by 24 percent of the men and only 8 percent of the women.

Table 4B shows the fall 1993 employment as it depends on citizenship status. Among non-U.S. citizens, 28 percent expected to hold a position in a Group I-V department, and 22 percent of U.S.

citizens expected to hold a position in a Group I-V department. Similar to the patterns seen in Fall I, U.S. citizens held jobs in bachelors-granting departments in higher proportion than non-U.S. citizens. Among U.S. citizens, 24 percent held a position in a Group B department, while 7 percent of non-U.S. citizens held a position in a Group B department.

Table 5 reports the types of changes made by those individuals who had any change in their employment between Fall I and fall 1993. An es-

**Table 7: Estimated Fall 1993 Employment Plans**  
of 1990-1991 Doctoral Recipients in the Mathematical Sciences Whose First Position Was in  
Academia, by Tenure Status in First Fall after Doctorate  
*(Includes only those whose position or known address in fall 1991 was in the U.S.)*

(7 March 1995) Type of Employer Fall 1993	Tenure Status in First Fall after Doctorate						Row Total	
	Tenurable		Nontenurable		Unknown Tenure Status		Row Total	
	Number	Percent*	Number	Percent*	Number	Percent*	Number	Percent*
Group I	3	1	54	24			57	10
Group II	5	2	5	2	3	10	12	2
Group III	46	15	16	7	8	30	70	13
Group IV	21	7	5	2	3	10	28	5
Group V	5	2	7	3			12	2
Masters	69	23	27	12	3	10	99	18
Bachelors	102	34	23	10	5	20	131	24
Two-Year Colleges	17	6	9	4			26	5
Other Academic Depts.	18	6	16	7	3	10	37	7
Research Institutes			5	2			5	1
Government			8	4			8	1
Business and Industry			2	1			2	0
Foreign, Academic	3	1	9	4	3	10	14	3
Foreign, Nonacademic			2	1			2	0
Not Seeking Employment								
Still Seeking Employment	13	4	39	17			51	9
Unknown (U.S.)	3		17		20		40	
Unknown (Foreign)***			19		5		24	
Column Total	304	100%**	264	100%**	51	100%**	619	100%**

\* Percentage of those whose employment status is known.

\*\* Column percents are rounded to the nearest whole percent.

\*\*\* Non-U.S. citizens who returned to their country and whose status is reported as "unknown" or "still seeking employment".

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

estimated 401 individuals in the target population had changed their employment status at some time in this period. The trend away from academic employment and the flow from doctorate-granting to non-doctorate-granting departments can be readily seen.

### Tenure Status and Academic Employment

In the 1991 Annual Survey, approximately 50 percent of the individuals holding academic employment had positions that were term-contract, non-tenure-eligible positions. Almost half of the non-tenure-eligible positions had contract durations of one or two years. Because of the uncertain future of these positions, the Employment Profile Survey also examined changes in tenure status and the evolution of employment status as a function of eligibility for tenure.

Tables 6A reports tenure status by type of academic employer in Fall I. Table 6B reports the same cross-tabulation in fall 1993.

In Fall I, an estimated 54 percent of the academic positions were tenure-eligible among those

positions for which tenure status was known. There were striking variations in the percentage of tenure-eligible positions across different types of departments. While only 5 percent of the positions held in Group I departments were tenure eligible, 85 percent of the positions in Group B departments were tenure eligible. In the doctorate-granting departments overall (Groups I-V), 35 percent of the positions were tenure eligible. In the non-doctorate-granting departments (Groups M and B), 84 percent of the positions in Fall I were tenure eligible.

In fall 1993, there were fewer total academic positions, but a higher proportion were tenure eligible. In fall 1993, an estimated 76 percent of the academic positions were tenure eligible among those positions for which tenure status was known. Variations are still seen in the percentage of tenure-eligible positions across different types of departments. By 1993, 14 percent of the positions held by the 1990-91 doctoral recipients in Group I departments were tenure eligible; the increase in the percentage is attributable more to the decrease in the number

**Table 8: Estimated Fall 1993 Tenure Status**

of 1990–1991 Doctoral Recipients in the Mathematical Sciences by Tenure Status in the First Fall After Doctorate

(Includes only those whose position or known address in fall 1991 was in the U.S.)

The subpopulation reported includes individuals whose first position and whose position planned for Fall 1993 were both academic.

Tenure Status in Fall 1993	Tenure Status in First Fall after Doctorate			Row Total
	Tenurable	Nontenurable	Unknown Tenure Status	
Tenurable	281	66	3	350
Nontenurable	0	108	0	108
Unknown Tenure Status	8	20	23	51
Column Total	289	194	26	509

Source: 1993 Annual AMS-IMS-MAA Employment Profile Survey (April 1994)

of non-tenure-eligible positions than to an increase in the estimated number of tenure-eligible positions. In fall 1993, 90 percent of the positions in Group B departments were tenure eligible. In the doctorate-granting departments overall (Groups I–V), 62 percent of the positions were tenure eligible. In the non-doctorate-granting departments (Groups M and B), 93 percent of the positions in fall 1993 were tenure eligible.

Between Fall I and fall 1993, the total number of tenure-eligible positions increased by 53 (17 percent).

Table 7 shows the dependence of employment plans for fall 1993 on tenure status in Fall I. It is apparent that holding a tenure-eligible position affects the stability of employment. Among the subpopulation that held tenure-eligible positions in Fall I, only 4 percent reported that they were unemployed and seeking employment for fall 1993. All of the others from this subpopulation whose employment status was known remained in academic positions. Among those who held non-tenure-eligible positions in Fall I, 17 percent were unemployed and seeking employment for fall 1993.

The likelihood of holding a fall 1993 position in a doctorate-granting department, and especially in a Group I department, is much higher among the subpopulation that held non-tenure-eligible positions in Fall I. In fall 1993, an estimated 24 percent of the non-tenure-eligible subpopulation planned to hold a position in a Group I department, compared to 1 percent of the tenure-eligible subpopulation. In contrast, members of the subpopulation that held tenure-eligible positions in Fall I are much more likely to have held a position in a Group B or M department in fall 1993 (57 percent of the tenure-eli-

gible subpopulation vs. 22 percent of the non-tenure-eligible subpopulation).

Table 8 reports estimated transitions in tenure status for the 509 individuals who are estimated to have held academic employment both in Fall I and in fall 1993. Among this group of 1990–91 doctoral recipients, 60 percent held tenure-eligible positions in Fall I, and 76 percent expected to hold tenure-eligible positions in fall 1993. The change in percentage reflects both an increase in the number of tenure-eligible positions and a decrease in the number of non-tenure-eligible positions held by this group.

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