

Chapter 2

MATHEMATICAL SCIENCE FACULTY: UNIVERSITIES
AND FOUR-YEAR COLLEGES

This chapter describes the number, educational qualifications, and selected personal characteristics of mathematical science faculty in universities and four-year colleges during fall, 1980. The data are compared and contrasted with faculty information from previous CBMS surveys and other studies of higher education in the sections that follow.

Highlights

- o From 1975 to 1980 the full-time mathematical science faculty in universities and four-year colleges increased by 8% compared to a 3% increase in all faculty of these institutions.
- o The part-time mathematical science faculty increased by 75% compared to a 28% increase of part-time faculty in all higher education.
- o The greatest percentage increase of full-time faculty was in computer science (university departments +25%) and in private college mathematics departments (+16%).
- o The increase in part-time faculty has occurred in every type of department. Further, use of teaching assistants doubled in computer science and private college mathematics departments.
- o The percent of public and private college faculty holding doctorates declined (74% to 69% and 69% to 64%) during the five-year period. Public college computer science faculty are least likely to hold doctorates (51%).
- o The age profile and median age of mathematical science faculty have not changed markedly over the past five years. However, the overall tenure rate has dropped from 72% to 67% and in computer science only 49% are tenured.
- o The number of women on mathematical science faculties has increased from 10% to 14%, with median age for women faculty about five years less than that for men.

2.1 Characteristics of Faculty in All Higher Education

For most colleges and universities the past five years have been a period of increasingly restricted resources to meet still growing student populations. At the same time there have been pressures to increase numbers of minority and women faculty and to keep untenured faculty positions for new entrants into the profession.

In the competition for scarce resources, the needs of the mathematical sciences are compared to those of other university departments and programs in search of some quantitative guides to decision making. The data in this section indicate the current situation and longer trends in all higher education faculty numbers, tenure, and teaching loads. They provide a useful backdrop for judging the status of the mathematical sciences.

FACULTY IN ALL HIGHER EDUCATION, 1965-1980

Since 1965, the full-time faculty in higher education has increased by 89% and the part-time faculty by 76%. However, the student faculty ratio has also increased in the same time period. The growth in two-year college faculty has been at a much greater rate than in four-year institutions.

Table 2.1
(faculty in thousands)

	1965	1970	1975	1980*
Four-year Institutions				
FTE Faculty	NA	322	360	372
FTE Students/FTE Faculty**	NA	16.1	16.4	16.9
All Higher Education				
Full-Time Faculty	248	369	430	468
Part-Time Faculty	92	104	142	162
FTE Students/FTE Faculty	16.8	16.6	17.4	18.2

*Projected

**FTE equals full-time plus one third of part-time

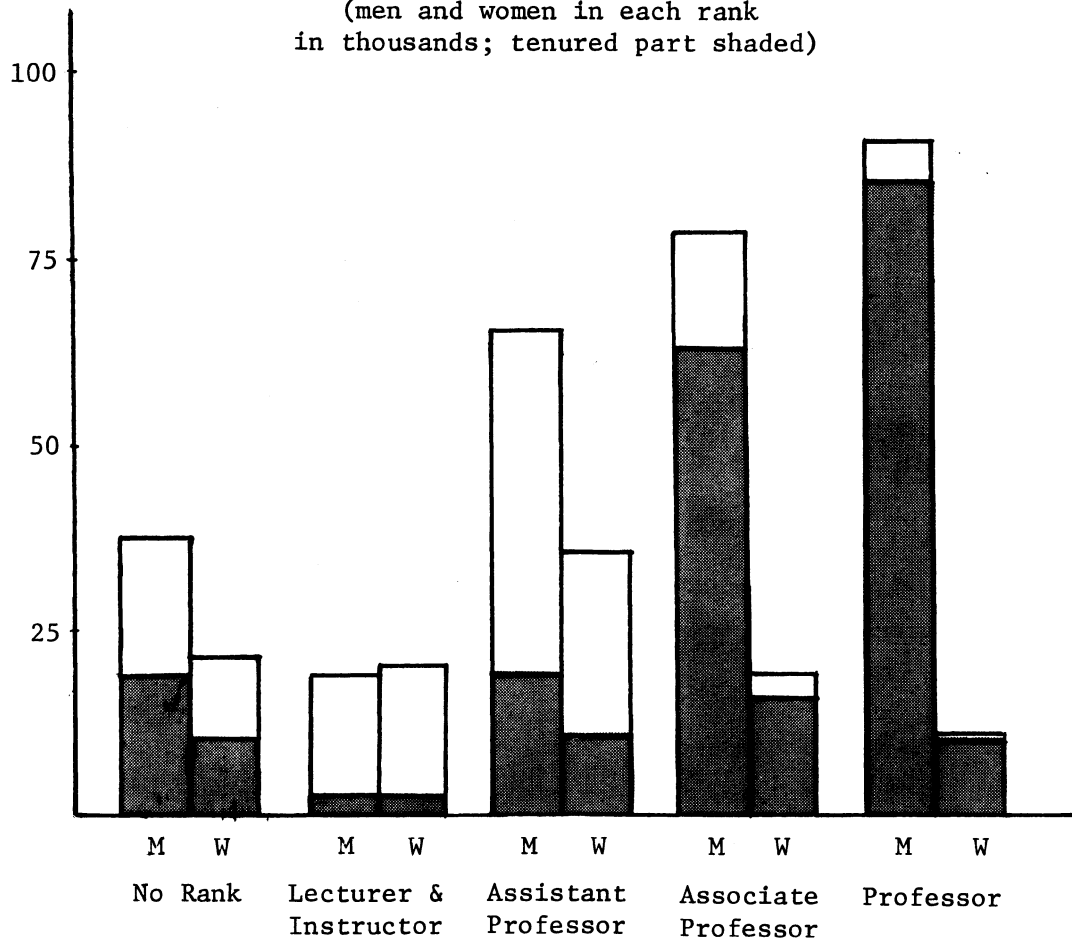
Source: Projections of Education Statistics to 1985-86.

DISTRIBUTION OF FULL-TIME FACULTY BY RANK, TENURE STATUS,
AND SEX IN 1979-1980

In all higher education men comprise 74% of the full-time faculty. Over 64% of these men hold tenure, compared to 43% of women faculty; men represent 90% of the full professors and 80% of the associate professors.

Figure 2.1

(men and women in each rank
in thousands; tenured part shaded)



Source: Smith, C. R., Faculty Salaries, Tenure, and Benefits 1979-80.

2.2 Faculty in Departments of Mathematics, Statistics, and Computer Science

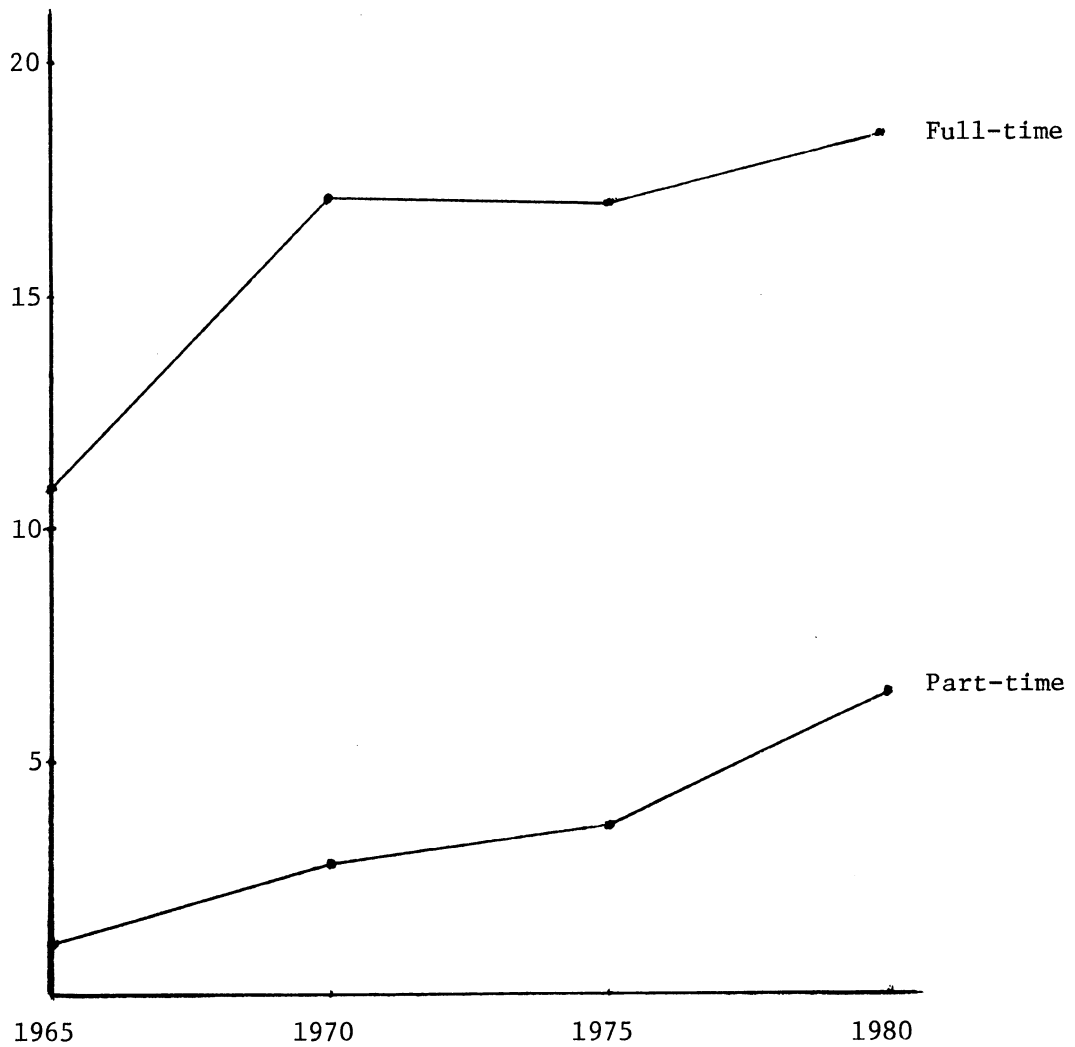
Between 1970 and 1975 the size of the full-time mathematical science faculty decreased by about 1% in colleges and universities, despite an 8% increase in mathematical science enrollments during that period. Some of the course load was covered by a 27% increase in part-time faculty, but enrollments per FTE faculty member increased by 18%. Given this trend of faculty size falling behind enrollment growth, the 33% increase in enrollments between 1975 and 1980, a period of diminishing resources for all higher education, was likely to outstrip new faculty positions. The data in this section show that while FTE mathematical science faculty increased between 1975 and 1980, the percent increase (13%) fell far behind enrollment growth.

Because the growth of mathematical sciences has been most dramatic in computer science, many of the additions to faculty would be expected in computing. Further, these relatively new departments in a young field are also likely to have different age and tenure profiles than the maturing mathematics departments. This section includes data bearing on these questions as well.

UNIVERSITY AND FOUR-YEAR COLLEGE MATHEMATICAL SCIENCE FACULTY, 1965-1980

From 1975 to 1980 full-time mathematical science faculty increased by 8% and part-time faculty increased by 75%. The FTE faculty thus increased by 13% compared to an increase of 33% in mathematical science enrollments. The total FTE faculty in universities and four-year colleges increased by only 3% in the same time period.

Figure 2.2
(faculty in thousands)



FACULTY IN MATHEMATICS, STATISTICS, AND COMPUTER SCIENCE, 1980

From 1975 to 1980 the largest faculty increase occurred in private college mathematics departments (+832 FTE). Faculty in departments of computer science also increased to a number about 9% of all FTE mathematical science faculty. These two types of departments also experienced the greatest course enrollment increases.

Table 2.2

Type of Department	1970		1975		1980	
	Full	Part	Full	Part	Full	Part
Universities						
Mathematics	6,235	615	5,405	699	5,605	1,038
Statistics	700	93	732	68	610	132
Computer Science	688	300	987	133	1,236	365
Public Colleges						
Mathematics	6,068	876	6,160	1,339	6,264	2,319
Computer Science	NA		NA		436	361
Private Colleges	<u>3,352</u>	<u>945</u>	<u>3,579</u>	<u>1,359</u>	<u>4,153</u>	<u>2,099</u>
Total	17,043	2,829	16,863	3,598	18,304	6,314

MATHEMATICAL SCIENCE TEACHING ASSISTANTS IN UNIVERSITIES
AND FOUR-YEAR COLLEGES

The number of teaching assistants doubled from 1975 to 1980 in computer science and private college mathematics departments, while use of TA's declined in statistics and public college mathematics departments. Over 20% of all TA's are not graduate students, up from only 6% in 1975. In university mathematics departments an even greater fraction are not mathematics graduate students.

Table 2.3

Type of Institution	1970	1975	1980
Universities			
Mathematics	5,999	5,087	5,491
Computer Science	309	835	1,813
Statistics	747	690	546
Public Colleges			
Mathematics	1,804	1,805	1,535
Computer Science	NA	NA	90
Private Colleges	<u>146</u>	<u>559</u>	<u>1,154</u>
Total	9,005	8,976	10,629

2.3 Educational Qualifications of Mathematical Science Faculty

Mathematical science faculties in colleges and universities grew most rapidly during the 1960's. At the same time the production of doctorates in the field increased, creating a pool of well qualified new faculty members, and in every type of four-year mathematical science department the fraction of the faculty holding doctorates increased.

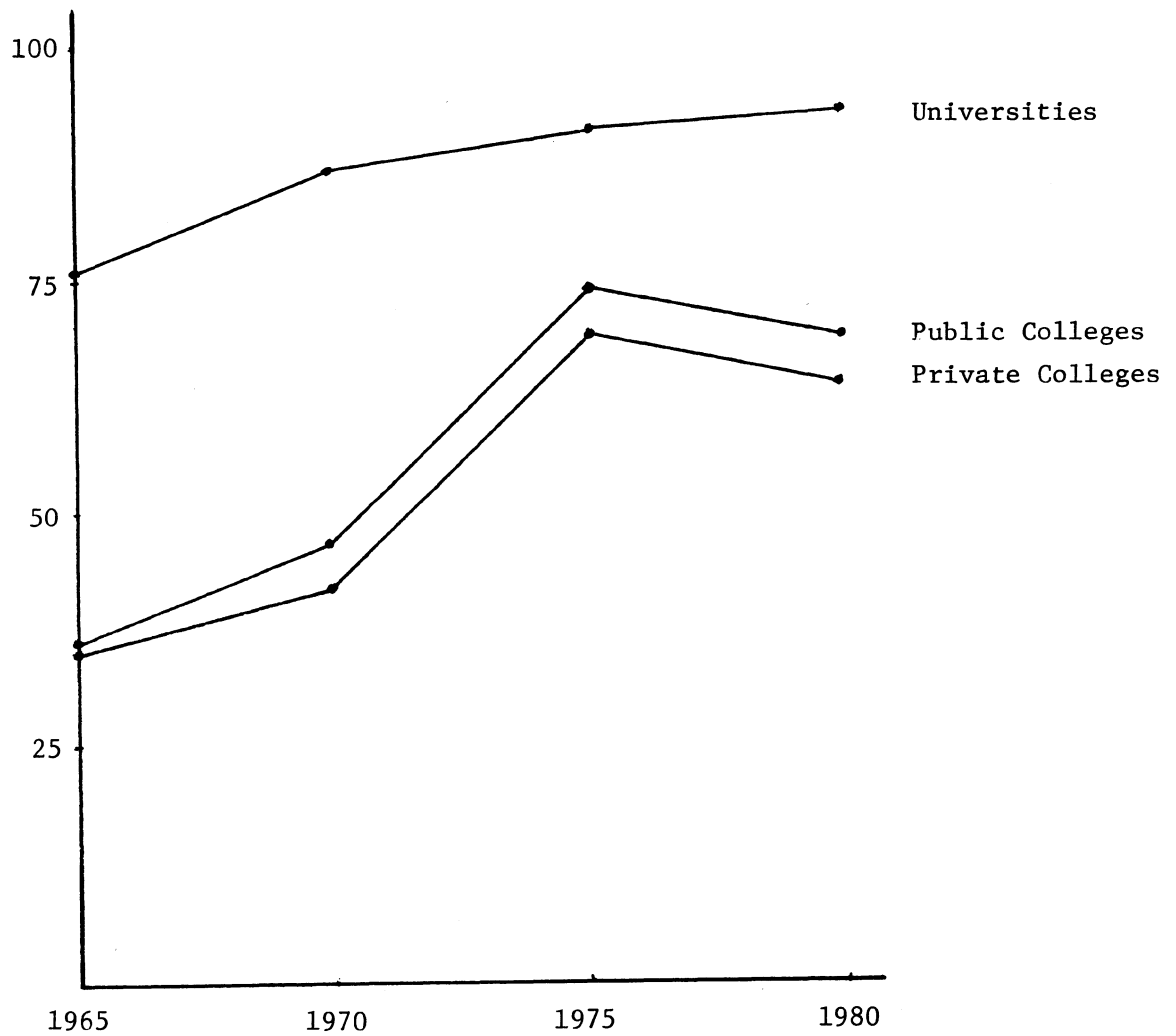
Since 1975, the number of doctoral degrees annually in mathematics has declined and the doctorates in computer science have not grown nearly fast enough to meet the demand for new faculty in these departments. Combined with the huge increase in mathematical science enrollments, these trends in the faculty pool raise concern about decline in the educational qualifications of university and four-year college faculties. The growing fraction of positions covered by part-time faculty adds another troublesome element to the situation.

Survey data suggest that, while university mathematical science departments have been able to maintain a high level of doctoral faculty, in both public and private colleges the fraction of non-doctoral faculty has increased since 1975.

DOCTORATES AMONG FULL-TIME MATHEMATICAL SCIENCE FACULTY

From 1975 to 1980 the fraction of public and private four-year college faculty with earned doctorates decreased, reversing the trend of 1965 to 1975.

Figure 2.3
(percent holding doctorate)



FIELD OF HIGHEST DEGREE FOR FULL-TIME MATHEMATICAL
SCIENCE FACULTY, 1980

In four-year colleges, those faculty whose highest degree is in computer science are least likely to hold a doctorate, indicating demand for those skills regardless of degree.

Table 2.4
(number of faculty and % doctorate by field of highest degree)

Type of Institution	Field of Doctorate				
	Mathematics	Statistics	Computer Science	Mathematics Education	Other
Universities (6,937 doctorates)	5,326 (94%)	793 (98%)	862 (89%)	125 (86%)	320 (87%)
Public Colleges (4,670 doctorates)	4,607 (70%)	429 (89%)	583 (59%)	800 (63%)	280 (77%)
Private Colleges (2,652 doctorates)	3,196 (65%)	209 (59%)	218 (39%)	283 (64%)	247 (75%)

FIELD OF HIGHEST DEGREE FOR FULL-TIME STATISTICS AND
COMPUTER SCIENCE FACULTY, 1980

Virtually all statistics department faculty hold a doctorate in statistics. Over 90% of university computer science faculty hold doctorates, but 40% of these are not in computer science. In public college computer science departments 59% of the faculty hold doctorates, again in a variety of different fields.

Table 2.5
(number of faculty and % doctorate by field of highest degree)

Type of Department	Field of Highest Degree				
	Mathematics	Statistics	Computer Science	Mathematics Education	Other
University Statistics	55 (83%)	533 (98%)	0	0	22 (86%)
University Computer Science	222 (91%)	16 (100%)	766 (90%)	0	235 (88%)
Public College Computer Science	106 (55%)	5 (100%)	218 (61%)	19 (74%)	88 (55%)

FIELD OF HIGHEST DEGREE FOR PART-TIME MATHEMATICAL
SCIENCE FACULTY, 1980

From 1975 to 1980 the number of part-time faculty increased by 75%. The fraction of this part-time faculty holding doctorates is much lower than the full-time faculty. Since 1975 that doctorate percentage has dropped sharply among part-time university faculty.

Table 2.6
(number and % doctorates by field of highest degree)

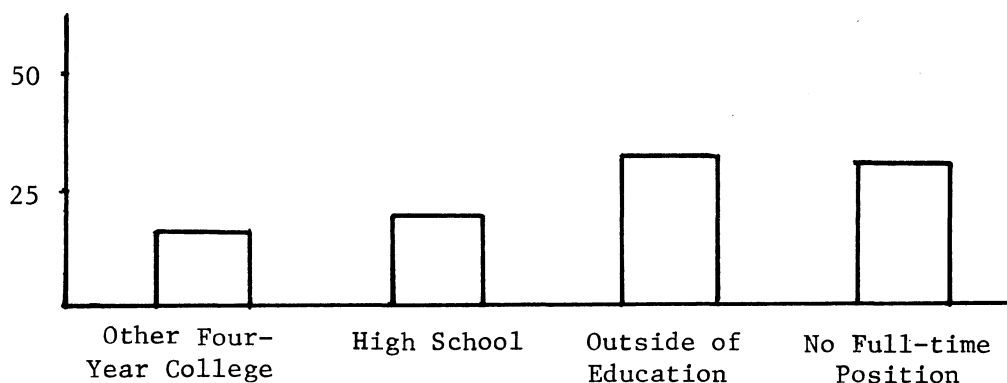
Type of Institution	Field of Highest Degree				
	Mathematics	Statistics	Computer Science	Mathematics Education	Other
Universities	905 (24%)	107 (63%)	288 (32%)	59 (35%)	177 (39%)
Public Colleges	1,464 (20%)	72 (43%)	354 (17%)	348 (17%)	442 (45%)
Private Colleges	1,364 (30%)	45 (19%)	184 (34%)	221 (21%)	285 (51%)

SOURCES OF PART-TIME MATHEMATICAL SCIENCE FACULTY, 1980

There are substantial numbers of part-time faculty members drawn from positions in high schools, other four-year colleges, non-academic work, and other part-time work.

Figure 2.4

(% of part-time faculty with given other employment)



Mathematics, statistics, and computer science departments seem to draw their part-time faculties from different sources.

Table 2.7

(% of part-time faculty with given other employment)

Type of Department	Other 4-Year College	High School	Non-Academic Position	No other full-time Position
Universities				
Mathematics	9%	19%	26%	45%
Statistics	22%	-	52%	25%
Computer Science	34%	-	51%	15%
Public Colleges				
Mathematics	15%	23%	29%	32%
Computer Science	11%	4%	74%	11%
Private Colleges	18%	16%	30%	36%

2.4 Age, Tenure, Sex, and Racial Composition of Mathematical Science Faculty

Over the past ten years faculty in all higher education became older and increasingly tenured as the rapid growth of the 1960's slowed markedly. For the mathematical sciences, fields well known for major contributions by young faculty, the problems of an aging and highly tenured faculty raise special concerns.

Women and minorities have traditionally been underrepresented as students and faculty in mathematics, science, and engineering. The 1975 CBMS survey showed 10% of all mathematical science faculty were women, and these were concentrated in younger age groups. Blacks (1%) and Hispanics (1%) also comprised a very small fraction of mathematical science faculty in 1975.

Data in this section show some encouraging effects of recent work designed to increase participation of women in mathematics, an increase from 10% to 14% of the full-time faculty. The number of black mathematical science faculty has doubled since 1975, but still constitute less than 3% of the total.

AGE DISTRIBUTION OF FULL-TIME MATHEMATICAL SCIENCE
FACULTY, 1975 AND 1980

From 1975 to 1980 the age profile of full-time mathematical science faculty in universities and four-year colleges did not change much, though the median age is now perhaps one year older. The only significant overall change was a decline for age range 30-34: in 1975 twenty-two percent of the faculty fell in that age range, while in 1980 only seventeen percent did. In compensation, the percentages in each of the age ranges 35-39, 40-44, 45-49, 50-54, 55-59 were roughly one higher in 1980 than in 1975.

Public colleges tend to have the fewest faculty members under 35 (20%) and private colleges the fewest over 50 (14%). In all three types of institutions, only 5% of the faculty is over 60 years old and the median age is about 40 years.

Table 2.8
(% in each age interval, 1980)

Type of Institution	Age Interval							
	<30	30-34	35-39	40-44	45-49	50-54	55-59	>60
Universities (7,451 faculty)	13%	17%	18%	17%	13%	11%	6%	5%
Public Colleges (6,700 faculty)	6%	14%	23%	23%	13%	10%	7%	4%
Private Colleges (4,153 faculty)	12%	20%	37%	11%	7%	6%	3%	5%
All Institutions (18,304 faculty)	10%	17%	23%	18%	12%	10%	6%	5%

TENURE STATUS OF MATHEMATICAL SCIENCE FACULTY, 1980

In 1980, 67% of mathematical science faculty had tenure compared to 72% in 1975 and 58% for all higher education. Mathematics and statistics departments are much more heavily tenured than computer science (less than 50%). This last fact represents a change from 1975 when 65% of computer science faculty were tenured. The newly established computer science departments appear to be building their own faculties now, not drawing tenured faculty from related fields.

Table 2.9

Type of Institution	Tenured Ph.D.	Tenured non-Ph.D.	Non-Tenured Ph.D.	Non-Tenured non-Ph.D.
Universities	64%	4%	28%	4%
Mathematics	67%	4%	25%	4%
Statistics	62%	2%	35%	1%
Computer Science	48%	4%	41%	7%
Public Colleges	52%	19%	16%	13%
Mathematics	53%	20%	15%	12%
Computer Science	38%	11%	25%	26%
Private Colleges	38%	16%	26%	20%
All Institutions	55%	12%	23%	10%

NEWLY TENURED MATHEMATICAL SCIENCE FACULTY, 1975 AND 1980

The rate at which mathematical science faculty gain tenure dropped sharply between 1975 and 1980. In 1980 only 1.5% of the full-time faculty were granted tenure compared with 4.6% in 1975. The modal year of doctorate for those granted tenure was 1974; however, in public colleges the 95 newly tenured faculty had doctorates evenly distributed from 1968 through 1975.

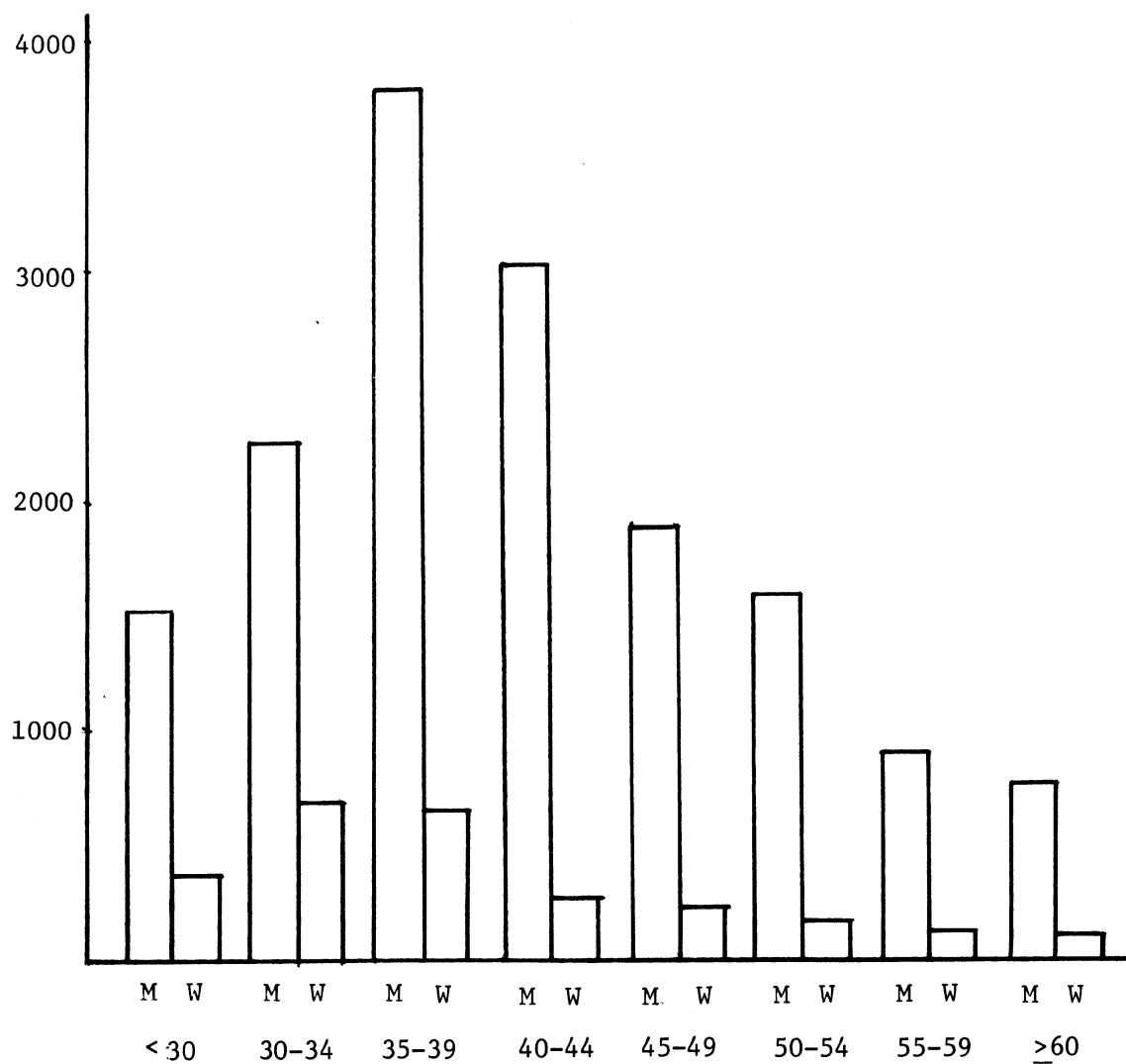
Table 2.10
(% of full-time faculty)

Type of Department	1975	1980
Universities		
Mathematics	4%	1.1%
Statistics	6%	4.1%
Computer Science	7%	2.6%
Public Colleges		
Mathematics	4%	1.5%
Computer Science	NA	4.6%
Private Colleges	5%	1.1%

DISTRIBUTION OF FULL-TIME MATHEMATICAL SCIENCE FACULTY
BY AGE AND BY SEX, 1980

Women comprise 14% of mathematical science faculty, the greatest number in public colleges (18%) and least in universities (9%). All three figures are up substantially from 1975 when only 10% of the mathematical science faculty were women. The median age for women is about five years less than that for men.

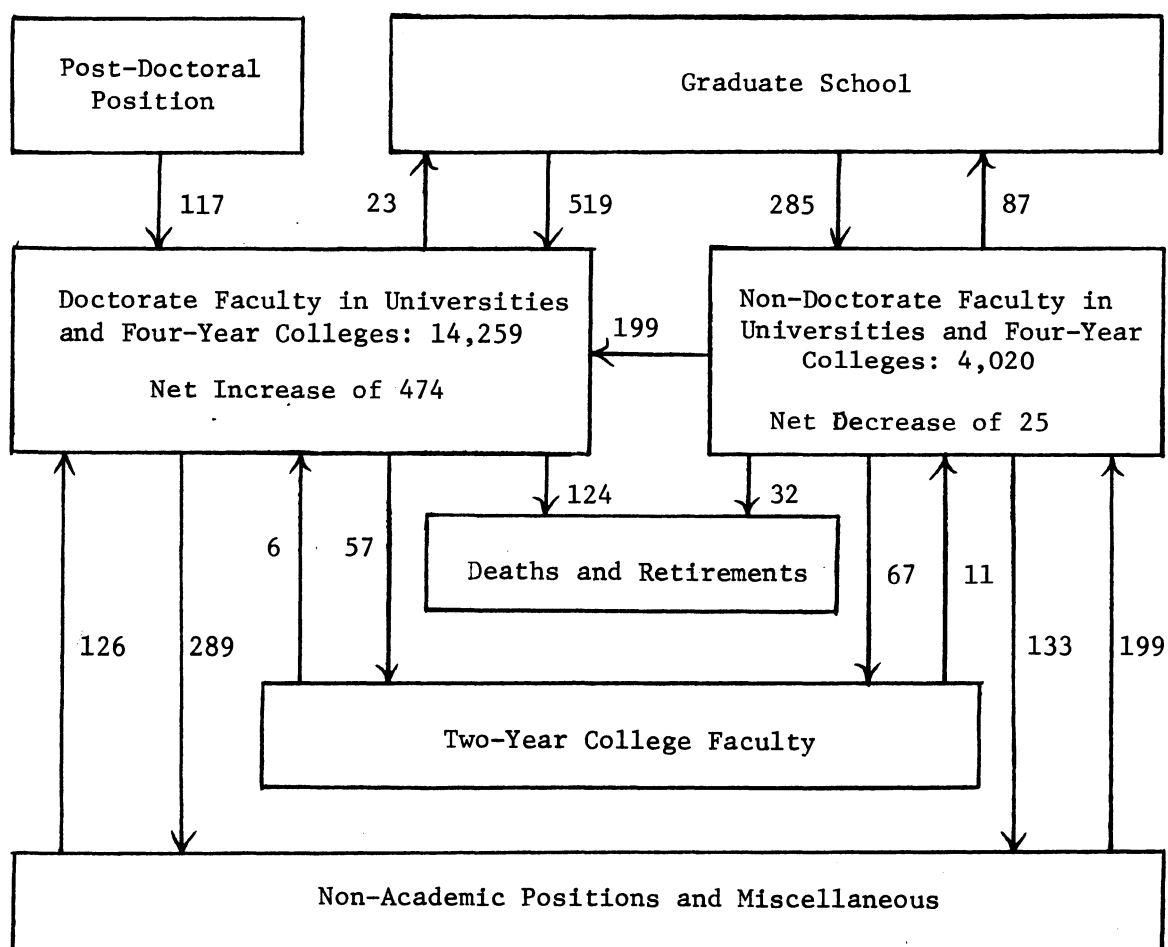
Figure 2.5
(numbers of men and women in each age interval)



FACULTY MOBILITY IN UNIVERSITY AND FOUR-YEAR
COLLEGE MATHEMATICAL SCIENCE DEPARTMENTS, 1979 to 1980

As in 1974-75 graduate school is the source of the greatest number of new university and four-year college mathematics faculty. However, the number of faculty added from non-academic positions is much greater in 1980 at both the non-doctoral (197 compared with 3 in 1975) and doctoral level (126 compared with 46 in 1975). Public and private college mathematics departments are hiring most of the new non-doctoral faculty. A substantial share (83) of the doctoral faculty leaving for non-academic positions are from university mathematics departments.

Figure 2.6
(numbers of full-time faculty)



2.5 Summary

Between 1975 and 1980 the full-time mathematical science faculty of universities and four-year colleges increased by 8% to 18,279. The growth rate compares favorably with the 3% increase in all faculty of universities and four-year colleges. The mathematical science faculty growth was concentrated in the computer science and private college mathematics departments which experienced greatest course enrollment increases during the period.

The number of women on full-time mathematical science faculties increased from 10% to 14%, and the number of blacks doubled (though to only 3%). In contrast to predicted trends toward older, highly tenured faculties, the age profile of mathematical science faculty in 1980 is very similar to that of 1975 and the fraction with tenure actually dropped from 72% to 67%.

In contrast to this optimistic view of developments for mathematical science faculty, the survey data show some disturbing trends. From 1975 to 1980 the part-time faculty increased by 75%. The increase in full-time-equivalent faculty (+13%) fell far short of the 33% increase in mathematical science enrollments. The use of teaching assistants doubled in computer science and private college mathematics departments and a sharply higher fraction of these TA's are not mathematical science graduate students. The doctorate share of full-time mathematical science faculty declined in public and private colleges, with as few as 51% of public college computer science faculty holding doctorates.

There are several other puzzling findings in the faculty data. In 1975 there were 2,700 full-time mathematical science faculty in the 40-44 year age group. Five years later, in 1980, this group that one would expect to be very stable had shrunk by 500. The data on faculty mobility show that in one year, 1979-80 nearly 300 doctorate faculty left universities and four-year colleges for non-academic positions. Together with the widely reported shortage of qualified computer science faculty, these data raise concerns that the financial gap between academic and industrial positions may be drawing away a number of very capable faculty -- with less qualified people entering to fill their places. The reductions in numbers of mathematics graduate students does not offer encouragement for the future.