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4

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A Note on Sex Segregation in Professional Occupations

Recent discussions among economists of male-female differences in the labor market show increasing interest in occupational segregation.[1] There is considerable agreement that a reduction in occupational segregation is an essential step in the movement toward greater economic and social equality between men and women, but there is much less agreement that any progress has been made in this direction. To help clarify recent trends, this note focuses on the group of occupations described by the Bureau of the Census as "Professional, technical, and kindred workers." This group, which accounted for 14 per cent of total employment in 1970, includes many of the high-wage, high-prestige occupations in which segregation by sex has been most prevalent.

Traditionally, professionals constituted a higher percentage of all employed females than of males. As shown in Table 1 only 7 per cent of males were professionals in 1950 compared to 12 per cent of females. By 1970 the percentages were similar. In 1950 women constituted only 28 per cent of total employment, but they accounted for 40 per cent of all professional employment. By 1970 women's share of total employment had grown to 38 per cent, but their share of professional employment was unchanged at 40 per cent.

Some observers have interpreted the stability in the female share of professional employment as a continuation, if not accentuation, of occupa-

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TABLE 1 Per Cent of Employment in "Professional, Technical, and Kindred" Group; 1950, 1960, 1970

Category	1950	1960	1970
Males	7.3	10.3[a]	
		9.9[b]	13.5
Females	12.4	13.0[a]	
		12.7[b]	14.8
All	8.7	11.2[a]	
		10.8[b]	14.0

SOURCE: *U.S. Census of Population, 1960 Summary, Detailed Characteristics*, Table 202; ibid., *1970 Summary, Detailed Characteristics*, Table 221.
[a]Based on 1960 classifications.
[b]Based on 1970 classifications.

tional segregation. In my view, this is an incorrect inference. During the 1960's a massive number of married women with relatively low education and little experience joined the labor force.[2] Therefore it is not surprising that relatively few of these women entered professional occupations. When one looks at trends *within* the professional group, a significant decrease in segregation between 1960 and 1970 becomes apparent.

A simple index of sex segregation (S) can be obtained by taking one-half the sum of the absolute differences in the per cent distributions of males and females across a set of occupations.[3] Let

M_i = male employment in occupation i,

$m_i = (M_i/\sum_i M_i)(100)$,

F_i = female employment in occupation i,

$f_i = (F_i/\sum_i F_i)(100)$,

$T_i = M_i + F_i$.

Then

$$S = \frac{1}{2} \sum_i |m_i - f_i|.$$

This index has a range from zero, which indicates no segregation (the percentage distributions are identical), to 100, which indicates complete segregation (males and females are never in the same occupation).[4]

In 1950 the index for the professional group was equal to 67.8 per cent (see Table 2). One interpretation of that number is that over two-thirds of all professional women (men) would have had to be shifted to male- (female-) dominated occupations in order to eliminate sex segregation within the professions. In 1960 the index was down slightly to 66.2 per cent. In 1970, however, it was down sharply to 59.2 per cent. That is a large change for this index since it is based on the total stock of employ-

TABLE 2 Sex Segregation in Professional Occupations; 1950, 1960, 1970

Category	1950	1960	1970
Segregation index (S)	67.8	66.3[a]	
		66.2[b]	59.2
Standardized segregation index (S*) (Based on 1960 total employment in each occupation)	65.4	66.3[a]	
		66.2[b]	62.7

SOURCE: *U.S. Census of Population, 1960 Summary, Detailed Characteristics*, Table 202; ibid., *1970 Summary, Detailed Characteristics*, Table 221.
[a]Based on 1960 classifications (n = 51).
[b]Based on 1970 classifications (n = 33).

ment. Inevitably, most professional men and women who were working in 1960 would be working in the same occupations a decade later.

An alternative approach, Theil's "entropy index" ($\bar{I}$), also shows a large decline in segregation between 1960 and 1970. This index, derived from information theory, is defined as follows:[5]

$$\bar{I} = H_D - \sum_i W_i H_i$$

where,

$$H_D = \frac{\sum_i M_i}{\sum_i T_i} \log \frac{\sum_i T_i}{\sum_i M_i} + \frac{\sum_i F_i}{\sum_i T_i} \log \frac{\sum_i T_i}{\sum_i F_i},$$

$$W_i = \frac{T_i}{\sum_i T_i},$$

$$H_i = \frac{M_i}{T_i} \log \frac{T_i}{M_i} + \frac{F_i}{T_i} \log \frac{T_i}{F_i}$$

In 1960 H_D, a measure of the sex mix in the professional group as a whole, was .67; the sum of $W_i H_i$ across all the occupations was .37, thus resulting in a segregation index of .30. In 1970 H_D was still .67, but $\sum_i W_i H_i$ had risen to .42, thus resulting in a segregation index of .25.

The segregation indexes (S and $\bar{I}$) change because of one or both of the following reasons: (1) a change in the average amount of segregation within occupations; (2) differential rates of growth of occupations. If the highly segregated occupations tend to be the ones that are growing rapidly, the index will tend to rise even though segregation may be declining within each occupation. If the less segregated occupations are growing more rapidly, the reverse may result. For instance, in the following hypothetical example demonstrated in Table 3, the segregation index (S) declines from year one to year two even though there is an increase in segregation in every occupation.

TABLE 3 Hypothetical Example of Decline in Index but Increase in Segregation within Occupations

Occupation	Year 1		Year 2	
	Male	Female	Male	Female
A	70	10	40	0
B	20	20	60	50
C	10	70	0	50
	$S = 60$		$S = 50$	

In order to determine whether differential occupation growth was a significant factor affecting the degree of segregation over the last few decades, a standardized index was calculated based on the sex proportions in each occupation in 1970 (or 1950) multiplied by the total employment in each occupation in 1960.[6] More precisely, the standardized index (S^*) for 1970 is obtained as follows:

$$S^*_i = \frac{1}{2} \sum_i |m^*_i - f^*_i|,$$

where,

$$m^*_i = \frac{(M_i\ 70/T_i\ 70)(T_i\ 60)(100)}{\sum_i (M_i\ 70/T_i\ 70)(T_i\ 60)}$$

The resulting index for 1970 is 62.7. This shows what the segregation index would have been if the relative size of occupations had remained unchanged between 1960 and 1970. It suggests that approximately one-half of the decline in the segregation index (from 66.2 to 59.2) was due to decreasing segregation within occupations, and about one-half to the relatively faster growth of less segregated occupations. An alternative standardized index based on the 1970 distribution of employment by occupation and the 1960 male-female division within occupations yields a similar conclusion, as does a standardized version of the entropy index. When H_i in 1970 is weighted by the 1960 distributions, the segregation index ($\bar{I}$) is .275, exactly half-way between the unstandardized 1960 and 1970 values.

The standardized index (S^*) for 1950 is 65.4. This indicates that the decline of about one percentage point in the unstandardized index between 1950 and 1960 was the result of a small increase in segregation within occupations offset by the more rapid growth of less segregated occupations.

Which occupations contributed most to the decline in segregation between 1960 and 1970? Table 4 reveals that the largest contributions came from "elementary school teachers" and "registered nurses." In 1960 these two highly segregated occupations accounted for almost 54 per cent

TABLE 4 Sex Distribution of Employment in Professional Occupations, 1960 and 1970

Occupation[a]	1960 Per Cent Male	1960 m_i	1960 f_i	1960 $\lvert m_i - f_i \rvert$	1970 Per Cent Male	1970 m_i	1970 f_i	1970 $\lvert m_i - f_i \rvert$	Change in $\lvert m_i - f_i \rvert$ 1960–1970
Engineers	99.2	19.82	.26	19.56	98.4	18.23	.46	17.77	−1.79
Architects	98.0	.86	.04	.82	96.5	.83	.05	.78	−.04
Dentists	97.7	1.88	.07	1.81	96.6	1.35	.07	1.28	−.53
Foresters and conservationists	97.6	.72	.04	.68	96.0	.58	.05	.53	−.15
Operations and systems, researchers and analysts	96.9	.51	.04	.47	90.4	1.10	.19	.91	.44
Lawyers and judges	96.6	4.88	.26	4.62	95.2	3.97	.30	3.67	−.95
Other health practitioners	95.4	1.16	.07	1.09	93.5	.81	.09	.72	−.37
Physicians, medical and osteopathic	93.1	5.02	.60	4.42	90.8	3.91	.60	3.31	−1.11
Pharmacists	92.5	2.05	.26	1.79	88.1	1.49	.30	1.19	−.60
Technicians, except health, science, and engineering	92.5	1.53	.19	1.34	88.7	2.12	.42	1.70	.36
Life and physical scientists	91.7	3.32	.48	2.84	86.9	2.70	.63	2.07	−.77
Engineering and science technicians	91.0	12.62	2.01	10.61	89.1	10.99	2.04	8.95	−1.66
Accountants	83.6	9.50	2.98	6.52	74.0	7.99	4.24	3.75	−2.77
Religious workers	83.6	5.09	1.60	3.49	89.7	3.50	.60	2.90	−.59
Social scientists	80.3	.77	.30	.47	80.8	1.35	.49	.86	.39
Teachers, college and university	76.3	3.42	1.71	1.71	71.6	5.34	3.20	2.14	.43
Research workers, not specified	73.1	1.32	.78	.54	74.2	1.32	.70	.62	.08
Writers, artists, and entertainers	71.5	8.44	5.40	3.04	69.8	8.12	5.29	2.83	−.21
Computer specialists	70.2	.21	.15	.06	80.4	3.15	1.16	1.99	1.93

TABLE 4 (concluded)

Occupation[a]	1960 Per Cent Male	1960 m_i	1960 f_i	1960 $\lvert m_i - f_i \rvert$	1970 Per Cent Male	1970 m_i	1970 f_i	1970 $\lvert m_i - f_i \rvert$	Change in $\lvert m_i - f_i \rvert$ 1960–1970
Personnel and labor relations workers	67.1	1.58	1.27	.31	69.3	3.08	2.06	1.02	.71
Mathematical specialists	64.8	.37	.34	.03	65.7	.35	.28	.07	.04
Vocational and educational counselors	59.0	.44	.48	.04	56.4	.92	1.09	.17	.13
Farm management advisors	53.0	.16	.22	.06	83.6	.09	.02	.07	.01
Secondary school teachers	50.7	6.65	10.36	3.71	50.9	7.83	11.40	3.57	−.14
Social and recreational workers	40.0	1.12	2.72	1.60	41.4	1.69	3.62	1.93	.33
Other teachers, excluding college and university	37.7	1.42	3.76	2.34	35.7	1.10	3.04	1.94	−.40
Therapists	36.8	.21	.60	.39	36.7	.43	1.11	.68	.29
Health technicians and technologists	31.8	.93	3.21	2.28	30.4	1.21	4.20	2.99	.71
Librarians, archivists, and curators	16.8	.30	2.39	2.09	20.8	.41	2.36	1.95	−.14
Elementary school teachers	14.2	3.25	31.49	28.24	16.4	3.54	27.45	23.91	−4.33
Dieticians	7.2	.05	.89	.84	8.0	.05	.86	.81	−.03
Registered nurses	2.5	.37	22.47	22.10	2.7	.34	18.73	18.39	−3.71
Prekindergarten and kindergarten teachers	0.0	.00	2.57	2.57	2.1	.05	2.85	2.80	.23

SOURCE: *U.S. Census of Population, 1970 Summary, Detailed Characteristics*, Table 221.
[a]Listed in order of percentage male in 1960.

of all female professional employment; by 1970 they accounted for just over 46 per cent. The redistribution was toward less segregated, more rapidly growing occupations such as college and secondary school teaching, computer specialists, and health technologists.

What are the prospects for the 1970's? The rapidly growing female enrollments in professional schools such as law and medicine suggest that there will be a substantial decrease in sex segregation within occupations. I also think that the less segregated occupations will continue to grow more rapidly than the highly segregated ones.

NOTES

1. See, for instance, Weisskoff or Zellner.
2. See Fuchs.
3. See Duncan and Duncan.
4. This assumes that both sexes are employed in the group as a whole. Note that the level of the index is influenced by the level of disaggregation of occupations. It is important therefore, in making comparisons over time, to use the same occupational classification.
5. See Theil, pp. 644–653.
6. See Gibbs, who uses a standardized index based on the assumption that all occupations have the same number of personnel employed.

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