

Job and industry gender segregation: NAICS categories and EEO-1 job groups

An examination of gender segregation by jobs and industry reveals that industries classified in NAICS and job groups listed in the 2008 EEO-1 National Survey of Private Employers are more gender segregated than the total workforce; the largest contribution to gender segregation is attributable to differences in diversity across NAICS subcategories

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How are men and women distributed across job groups and industries? This article uses the 2008 EEO-1 National Survey of Private Employers¹ to explore the effects of industries and job groups on gender differences. The focus is the question, Which segments of the labor force contribute the most to gender segregation in the United States?² Of particular interest are the industry categories of the North American Industrial Classification System (NAICS), in relation to which the question becomes, Is gender segregation most likely in goods-producing industries or service-providing industries, and in which sectors does it occur?

The examination of gender segregation by jobs and industry is important for several reasons. First, it provides a benchmark for testing the impact of equal employment efforts, whether by legal enforcement, private litigation, or corporate human resource practices. Second, it plays a prominent role in the examination of gender wage gaps. Early human capital models of wage distributions focused largely on the characteristics of individual employees, such as schooling, work experience, and skill

levels. Later models incorporated differences in the proportion of men and women within and across occupations.³ Current research has expanded human capital models to explore gender distributions in both occupations and industries, including the effects of classifying occupations at different levels of aggregation.⁴ The presentation that follows can be viewed, in part, as an attempt to focus attention on the measurement implications of aggregating and disaggregating industry classifications.

The article is divided into (1) a brief introduction to the EEO-1 Survey of Private Employers, (2) a short description of entropy diversity measures, and (3) the crux of the article: a presentation of the empirical results from the 2008 survey based on the 2007 revision of NAICS.⁵

Description of EEO-1 data

The Equal Employment Opportunity Commission operates a data collection system that collects data from all private employers in the United States with more than 100 employees and from Federal contractors with 50 or more employees and contracts of \$50,000 or more. Title VII of the Civil Rights Act of 1964, as

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amended, allows the Commission to collect data for, and publish, EEO-1 reports. These annual reports indicate the composition of employers' workforces by gender and by race and ethnic categories.⁶ In 2008, more than 68,300 employers submitted individual establishment and headquarters reports for more than 250,650 reporting units with about 62.2 million employees.⁷ The reports present data on 10 major job categories: executive or senior-level officials, first- or midlevel officials, professionals, technicians, salesworkers, office and clerical workers, craftworkers, operatives, laborers, and service workers.⁸ Race and ethnic designations used in the 2008 EEO-1 report are Hispanic or Latino and, if neither, White, Black or African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaskan Native, plus a category for two or more races. In addition to the workforce data provided by the employer, information about each establishment is added to the database. Such information includes the establishment's 2007 NAICS code, county code, and metropolitan area code.⁹ The remainder of the article examines 19 private sector industries (or sectors) classified by NAICS two-digit code, 85 industries classified by three-digit code, and 279 industries classified by four-digit code.¹⁰

Measuring occupational segregation

The discussion that follows utilizes two indexes attributed to the Dutch economist Henri Theil: his entropy index (E) and information theory index (H). E measures gender diversity as the difference from an even 50-percent split between men and women. H is a measure of segregation examining to what extent different units (such as jobs or industries) have either all men or all women. The next two subsections describe, in more detail, how E and H are interpreted. (See the appendix for the mathematical formulas for E and H .)

Group diversity. The index E ranges from zero (no diversity) to 1.0 (complete diversity).¹¹ The minimum value of E indicates that only one group is present and all other groups are absent. The maximum value of E indicates that all groups are evenly distributed. In expressing gender segregation, E reaches a minimum value of 0.0 when there are either no women or no men—that is, when the proportion of women is 0.0 or the proportion of women is 1.0.¹² E reaches a maximum value of 1.0 when there is an even distribution of the genders (that is, when the proportion of women is 0.5 and the proportion of men is 0.5).¹³ Note that E is a measure of the diversity, rather than the

composition, of the group. A low value of E could result from either a predominance of men or a predominance of women.

Group segregation. The H index is a measure of segregation based on the diversity index E . Regarded as “the average difference between total and within-unit diversity divided by the total diversity . . . [and] a measure of the proportion of total diversity attributable to between-unit differences,”¹⁴ H ranges from 0.0 when each unit has the same diversity as the overall diversity to 1.0 when each unit has no diversity. For example, if all subindustries in a particular group have a 50–50 split between men and women, then each subindustry has an E value of 1.0 (complete diversity), the overall group has an E value of 1.0 (complete diversity), and the average difference in diversity between the group and the subindustries is an H value of 0.0. By contrast, if one or more subindustries have only men or only women employees (represented by an E value of 0.0), then the average difference in diversity between the overall group and the subindustries increases and the H value increases.

One of the advantages of the H index is that it can be partitioned into within- and between-unit components.¹⁵ The discussion that follows divides H into two components: an H value between industries and an H value within industries and between job groups. Each of these components can be expressed as a percentage of the overall H value. This approach quantifies how much particular industries and jobs contribute to overall gender segregation.

2008 EEO-1 results

This section examines the results from the 2008 EEO-1 survey. First, the contributions to overall gender segregation are analyzed on the basis of the percentage of H . Then the role of particular NAICS industries is examined in more detail. Finally, the role of specific EEO-1 job groups is considered. At each stage, two questions are asked: Which is more important, within-group differences in diversity or between-group differences in diversity? and Which industries or job groups contribute the most to differences in gender diversity? Of particular interest are the relative contributions of goods-producing and service-providing industries, as well as the relative contributions of the craft, operative, and clerical job groups.

Overall results. The following tabulation summarizes the overall gender statistics obtained from the 2008 survey:

<i>Category</i>	<i>Value</i>
Total employees	48,837,691
Men	25,644,805
Women	23,192,886
Percent women.....	47.49
<i>E</i> .....	.9982
<i>H</i>.....	.2170
Percent of <i>H</i> index.....	100.0

The total population reporting represents slightly under 50 million employees, almost evenly divided between women and men. Women employees make up 47.49 percent, for an *E* value of 0.9982. The overall *H* index is 0.2170, indicating that the organizational units—either industries or job groups (or both)—are about one-fifth more gender segregated (less gender diverse) than the total population reporting. The tabulation represents 100.0 percent of the overall *H* index. The remaining tables and tabulations describe the contributions of various industries and job groups to the overall *H* percentage.¹⁶

Table 1 shows the distribution of *H* percentages within and between the highest level NAICS categories: the domains of goods-producing and service-providing industries.¹⁷ Goods-producing industries include construction, mining, and manufacturing. Service-providing industries include health care, educational services, and retail trade. The rows of the table represent the NAICS domains, and the columns represent refinements of those domains, starting on the left with two-digit NAICS categories (or sectors) and ending on the right with EEO-1 job groups within four-digit NAICS categories. For example, the column totals show a total *H* percentage of 100.0 percent, consisting of three components: between domains (19.7 percent), within domains (45.0 percent, combining the middle columns of 30.7 percent, 9.1 percent, and 5.3 percent, whose sum rounds to 45.1 percent), and between EEO-1 job groups within NAICS four-digit categories (35.3 percent).

Taken as a whole, service-providing industries account for about two-thirds (64.4 percent) of total gender segregation and goods-producing industries account for about one-third (35.6 percent). The largest contribution to the total *H* percentage comes from within domains (45.0 percent), followed by between job groups (35.3 percent) and between domains (19.7 percent). The subunits within the domains, varying from two- to four-digit NAICS categories, can be regarded as measures of homogeneity. On the basis of column totals, the greater the specificity of the NAICS categories, the lower is the percentage of *H* values. About two-thirds of the within-domain variation (30.7 percent out of 45.0 percent) oc-

curs at the two-digit level. Increasing the NAICS level from two to three digits and then from three to four digits has less impact on within-domain *H* percentages (9.1 percent and 5.3 percent, respectively).

Perhaps the most interesting feature of table 1 is the contrast between the goods-producing and service-providing industries. About one-half of the total *H* percentage for goods-producing industries (18.2 percent out of 35.6 percent) takes place between domains. The next-largest contribution comes between job groups (11.2 percent), followed by within domains (6.2 percent). By contrast, service-providing industries show remarkably little variation between domains (1.4 percent), but substantial variation within domains (38.9 percent) and between job groups (24.1 percent). What accounts for these differences?

NAICS domains. The following tabulation shows the contributions to *H* between the goods-producing and service-providing domains:

<i>Category</i>	<i>Total</i>	<i>Goods producing</i>	<i>Service providing</i>
Number of employees	48,837,691	12,628,156	36,209,535
Percent women	47.49	27.28	54.54
<i>E</i> .....	.9982	.8454	.9940
<i>H</i> .....	.0426	.0396	.0031
Percent of <i>H</i> index...	19.65	18.24	1.41

Service-providing industries, as a whole, have about twice the percentage of female employees as do goods-producing industries (54.5 percent and 27.3 percent, respectively). Recall that gender equality is defined as an even 50:50 split between men and women. Because the percentage of women in service-providing industries is slightly above that designating gender equality and the EEO-1 national total for all industries (47.5 percent) is slightly below that required for gender equality, both groups have similar diversity levels. That is, the *E* value for service-providing industries is 0.994, the national *E* value is 0.998, and the difference in diversity levels is minimal. By contrast, the percentage of women in goods-producing industries is substantially lower than the national total for all industries. That is, the *E* value for goods-producing industries is 0.845 and the national *E* value is 0.998. Thus, there is a difference in diversity levels, and it follows that gender segregation is more prevalent in industries in the goods-producing domain (*H* percentage of 18.2) than in the service-providing domain (*H* percentage of 1.4).

Table 1. Partitioning of percent contributions to overall gender *H* value, 2008

Category			Within and between NAICS subcategories: two-, three-, and four-digit codes				Between EEO-1 jobs
Domain	Percent of total	Between-domain contribution	Within domain	Within domain, between two-digit categories	Within two-digit categories, between three-digit categories	Within three-digit categories, between four-digit categories	Within four-digit categories, between jobs
Total	100.00	19.65	45.04	30.66	9.09	5.29	35.31
Goods producing	35.59	18.24	6.16	2.36	2.63	1.17	11.19
Service providing	64.41	1.41	38.88	28.29	6.46	4.12	24.12

NOTE: Column entries may not sum to totals because of rounding.
SOURCE: North American Industry Classification System; National Survey of Private Employers.

NAICS two-digit sectors. Table 2 examines the next level of NAICS specificity: within domain industries and between two-digit sectors. The first row and the next four rows of the table list, respectively, the total goods-producing domain and the 4 two-digit sectors within that domain. The next row and the remaining rows list, respectively, the total service providing domain and the 15 two-digit sectors within that domain. The sectors within the two domains are sorted from high to low percentages of *H*. The columns of the table list selected characteristics, subdivided into within values and between values. For example, in the second row, the within values are for the goods-producing domain and the between values are for the construction sector. Thus, 12,628,156 employees work in the goods-producing domain and 1,519,283 employees work in the construction industry. The percentages of women are 27.3 percent for the goods-producing domain and 10.6 percent for the construction sector.

The goods-producing domain in table 2 illustrates several important characteristics of the diversity measure *H*. Until now, all of the percentages of *H* have been positive, indicating higher levels of gender segregation (less gender diversity). However, as the NAICS subcategories become more refined, it is also possible to have negative percentages of *H*, indicating lower levels of gender segregation (more gender diversity). Notice that the percentage of *H* for the construction industry is positive (5.2 percent) but that for the manufacturing industry is negative (-3.6 percent). The reason for the difference in sign is evident from the columns that show the percentages of women in the two industries. The construction industry has a smaller percentage of female employees than the goods-producing domain (10.6 percent and 27.3 percent, respectively), but the manufacturing industry has a larger percentage of female employees than the

goods-producing domain (30.1 percent and 27.3 percent, respectively). Thus, the construction industry is more segregated (less diverse) than the goods-producing domain, and the manufacturing industry is less segregated (more diverse) than the goods-producing domain. Consequently, the total percentage of *H* for NAICS two-digit sectors within the goods-producing domain (2.4 percent) represents a mixture of positive and negative values, indicating an additional source of heterogeneity within the subcategories. Note also that the agriculture and manufacturing industries have a similar percentage of women (33.9 percent and 30.1 percent, respectively) but different percentages of *H* (-0.2 percent and -3.6 percent, respectively). The larger percentage for manufacturing is due mostly to that industry's size, 10,409,437 employees, compared with 277,087 employees for agriculture.¹⁸

The service-providing domain in table 2 displays a different pattern of positive and negative percentages of *H*. The domain is dominated by a single positive outlier, the health care industry, with a percentage of *H* of 21.6 percent, compared with a percentage of 28.3 percent for the total service-providing domain. There are at least two reasons for a large percentage of *H* in the health care industry: the relative size of the industry and the predominance of women in it. About a quarter of the total employees in the service-providing domain are in the health care industry (8,957,076 out of 36,209,535). In addition, the percentage of female employees in the industry (79.2 percent) is substantially higher than the percentage of female employees in the service-providing domain as a whole (54.5 percent). The next-two-largest percentages of *H*, representing the transportation and warehousing and the wholesale industries, are 3.8 percent and 1.1 percent, respectively. The remaining percentages range in magnitude from 0.9 percent to -0.3 percent. Thus,

Table 2. H Contributions within NAICS domains and between NAICS two-digit sectors, 2008

Domain	NAICS sector		Number of employees		Percent women		E		Percentage of H
	Code	Title	Within domain	Between sectors	Within domain	Between sectors	Within domain	Between sectors	
Total goods producing	...	...	...	12,628,156	...	...	...	...	2.36
Goods producing	23	Construction	12,628,156	1,519,283	27.3	10.6	.845	.486	5.16
Goods producing	21	Mining, quarrying, and oil and gas extraction	12,628,156	422,349	27.3	14.1	.845	.588	1.03
Goods producing	11	Agriculture, forestry, fishing, and hunting	12,628,156	277,087	27.3	33.9	.845	.924	-.21
Goods producing	31-33	Manufacturing	12,628,156	10,409,437	27.3	30.1	.845	.882	-3.62
Total service providing	...	...	...	36,209,535	...	...	...	...	28.29
Service providing	62	Health care and social assistance	36,209,535	8,957,076	54.5	79.2	.994	.738	21.64
Service providing	48-49	Transportation and warehousing	36,209,535	2,496,978	54.5	26.3	.994	.832	3.83
Service providing	42	Wholesale trade	36,209,535	1,385,410	54.5	32.8	.994	.913	1.06
Service providing	22	Utilities	36,209,535	508,076	54.5	25.1	.994	.813	.87
Service providing	52	Finance and insurance	36,209,535	3,286,521	54.5	60.3	.994	.969	.78
Service providing	54	Professional, scientific, and technical services	36,209,535	3,051,639	54.5	42.0	.994	.982	.36
Service providing	61	Educational services	36,209,535	364,890	54.5	63.3	.994	.948	.16
Service providing	56	Administrative and support and waste management and remediation services	36,209,535	2,722,718	54.5	44.4	.994	.991	.08
Service providing	51	Information	36,209,535	1,971,877	54.5	44.8	.994	.992	.03
Service providing	53	Real estate and rental and leasing	36,209,535	441,074	54.5	44.8	.994	.992	.01
Service providing	71	Arts, entertainment, and recreation	36,209,535	871,047	54.5	46.8	.994	.997	-.02
Service providing	55	Management of companies and enterprises	36,209,535	454,706	54.5	50.2	.994	1.000	-.03
Service providing	81	Other services (except public administration)	36,209,535	784,741	54.5	52.8	.994	.998	-.03
Service providing	72	Accommodation and food services	36,209,535	3,023,260	54.5	51.3	.994	1.000	-.16
Service providing	44-45	Retail trade	36,209,535	5,889,522	54.5	51.5	.994	.999	-.30

SOURCE: North American Industry Classification System; National Survey of Private Employers.

unlike the goods-producing domain, the service-providing domain, with the exception of the health care industry, is relatively homogeneous, with few large positive percentages of H and no large negative percentages.

NAICS three- and four-digit categories. Tables 3 and 4 repeat the column format of table 2, but extend the display to three- and four-digit NAICS industries, respectively. Given the large number of such industries, the rows of the two tables are restricted to the five largest and five smallest percentages of H within the goods-producing and service-providing domains. For example, among the goods-producing industries, the three-digit transportation equipment manufacturing industry has the highest percentage of H (1.2 percent) and the three-digit food manufacturing industry has the lowest (-0.8 percent). Among the service-providing industries, the three-digit truck transportation industry has the highest percentage of H (1.3 percent) and the three-digit social assistance industry has the lowest (-0.7 percent).

Tables 3 and 4 exhibit some of the reasons NAICS three- and four-digit industries make minimal contributions to overall segregation levels. Notice that the percentages of H fall within a narrow range: those of goods-producing industries shown in table 3 range from 1.2 percent to -0.8 percent, and those of service-providing industries range from 1.3 percent to -0.7 percent. Likewise, the percentages of H among the goods-producing industries shown in table 4 range from 0.3 percent to -0.4 percent, and the percentages of H among the service-providing industries range from 1.0 percent to -0.4 percent. Regardless of the domain they are in, four-fifths of the three-digit NAICS industries have percentages of H in the range from 0.75 percent to -0.28 percent and four-fifths of the four-digit NAICS industries have percentages of H in the range from 0.09 percent to -0.05 percent.¹⁹ In addition, both domains in each table include industries with positive percentages of H and industries with negative percentages of H . This means that many of the percentages of H from outlying industries cancel each other out. For example, in the goods-producing domain shown in table 4, both ship and boat building (NAICS code 3366) and motor vehicle parts manufacturing (3363) are four-digit industries within the three-digit transportation equipment manufacturing industry (336). The percentage of female employees in the three-digit industry is 23.8 percent. Ship and boat building is less gender diverse (14.3 percent women) than the three-digit industry, and motor vehicle parts manufacturing is more gender diverse (31.2 percent women) than the three-digit industry. Consequently, ship and boat building

has a positive percentage of H of 0.23, motor vehicle parts manufacturing has a negative percentage of H of -0.37, and their combined percentage of H (-0.14) has little impact on the overall percentage of H .

EEO-1 job groups. Table 5 summarizes the contributions to overall gender segregation between EEO-1 job groups within NAICS four-digit industries. The rows list the 10 EEO-1 job groups, and the columns list the percentages of H . The job groups contribute about one-third (35.3 percent) of the total percentage of H : 11.2 percent from goods-producing industries and 24.1 percent from service-providing industries. The job groups with the highest percentages of H are craftworkers (11.7 percent), clerical workers (10.0 percent), and operatives (5.8 percent). The job groups with the lowest percentages of H are service workers (-0.23 percent), upper management (0.72 percent), and midlevel management (1.0 percent).

Craft, operative, and clerical job groups. Tables 6 through 8 list the 15 industries with the highest positive percentages of H for the craft, operative, and clerical job groups, respectively. The first four columns list, respectively, the rank, domain, code, and title of the four-digit NAICS industries, and the next six columns list various job and industry characteristics. The percentages of H , sorted in descending order, appear in the rightmost column.

The positive outliers for craft and operative workers represent job groups with a preponderance of male employees, often in industries with a preponderance of male employees. All of the NAICS four-digit industries in tables 6 and 7 have a minority of female employees. The percentage of female employees in these industries ranges from 8.1 percent to 42.8 percent in table 6 and from 8.3 percent to 49.8 percent in table 7. The median percentage of female workers is 24.8 percent for the industries shown in table 6 and 20.6 percent for those listed in table 7. Even so, the percentage of women in craft and operative jobs is smaller than the industry percentages, sometimes substantially. The median percentage of women in craft jobs is 3.9 percent and in operative jobs is 7.8 percent. As an example of the relative underrepresentation of women in craft jobs in the electrical power generation, transmission, and distribution industry (table 6, NAICS code 2211), the industry has 24.8 percent female employees and, of all craftworkers in the industry, 2.9 percent are women. Similarly, the building material and supplies dealers industry (table 7, NAICS code 4441) has 37.1 percent female employees and, of all operatives in the industry, 11.0 percent are women. In addition, in tables 6 and 7, at least two-thirds of the

Table 3. Highest and lowest contributions to *H* within NAICS sectors and between NAICS three-digit industries, 2008

Domain and sector	Three-digit industry		Number of employees		Percent women		<i>E</i>		Percentage of <i>H</i>
	Code	Title	Within sector	Between industries	Within sector	Between industries	Within sector	Between industries	
Goods producing									
Manufacturing	336	Transportation equipment manufacturing	10,409,437	1,440,169	30.1	23.8	0.882	0.791	1.24
Manufacturing	331	Primary metal manufacturing	10,409,437	376,643	30.1	14.7	.882	.603	1.00
Manufacturing	333	Machinery manufacturing	10,409,437	826,210	30.1	22.1	.882	.762	.94
Manufacturing	332	Fabricated metal product manufacturing	10,409,437	787,366	30.1	22.7	.882	.772	.82
Construction	238	Specialty trade contractors	1,519,283	718,394	10.6	8.2	.486	.410	.52
Manufacturing	334	Computer and electronic product manufacturing	10,409,437	1,202,076	30.1	32.2	.882	.907	-.28
Construction	236	Construction of buildings	1,519,283	413,663	10.6	15.8	.486	.629	-.56
Manufacturing	339	Miscellaneous manufacturing	10,409,437	721,230	30.1	40.7	.882	.975	-.63
Manufacturing	325	Chemical manufacturing	10,409,437	894,748	30.1	38.4	.882	.960	-.66
Manufacturing	311	Food manufacturing	10,409,437	1,224,818	30.1	36.6	.882	.947	-.75
Service providing									
Transportation and warehousing	484	Truck transportation	2,496,978	581,154	26.3	14.2	.832	.590	1.33
Retail trade	452	General merchandise stores	5,889,522	1,263,900	51.5	69.3	.999	.889	1.31
Health care and social assistance	623	Nursing and residential care facilities	8,957,076	1,922,384	79.2	82.2	.738	.675	1.15
Retail trade	441	Motor vehicle and parts dealers	5,889,522	445,269	51.5	20.2	.999	.726	1.15
Transportation and warehousing	482	Rail transportation	2,496,978	186,157	26.3	8.1	.832	.405	.75
Health care and social assistance	621	Ambulatory health care services	8,957,076	1,581,985	79.2	78.3	.738	.755	-.25
Transportation and warehousing	493	Warehousing and storage	2,496,978	294,968	26.3	35.8	.832	.941	-.30
Transportation and warehousing	485	Transit and ground passenger transportation	2,496,978	214,109	26.3	42.2	.832	.982	-.30
Transportation and warehousing	481	Air transportation	2,496,978	467,108	26.3	40.7	.832	.975	-.63
Healthcare and social assistance	624	Social assistance	8,957,076	637,811	79.2	72.0	.738	.855	-.70

SOURCE: North American Industry Classification System; National Survey of Private Employers.

Table 4. Highest and lowest contributions to H within NAICS three-digit industries and between NAICS four-digits industries, 2008

Domain and three-digit industry	Four-digit industry		Number of employees		Percent women		<i>E</i>		Percentage of <i>H</i>
	Code	Title	Within industry	Between industries	Within industry	Between industries	Within industry	Between industry	
Goods-producing									
Construction of buildings	2362	Nonresidential building construction	413,663	328,115	15.8	12.2	0.629	0.536	0.29
Chemical manufacturing	3251	Basic chemical manufacturing	894,748	152,424	38.4	22.6	.960	.772	.27
Transportation equipment manufacturing	3366	Ship and boat building	1,440,169	120,862	23.8	14.3	.791	.591	.23
Nonmetallic mineral product manufacturing	3273	Cement and concrete product manufacturing	223,977	74,994	19.4	10.4	.709	.481	.16
Fabricated metal product manufacturing	3323	Architectural and structural metals manufacturing	787,366	171,016	22.7	17.8	.772	.677	.15
Machinery manufacturing	3334	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	826,210	116,826	22.1	28.4	.762	.861	-.11
Fabricated metal product manufacturing	3329	Other fabricated metal product manufacturing	787,366	298,728	22.7	25.1	.772	.812	-.11
Chemical manufacturing	3254	Pharmaceutical and medicine manufacturing	894,748	436,568	38.4	49.0	.960	1.000	-.16
Construction of buildings	2361	Residential building construction	413,663	85,548	15.8	29.5	.629	.875	-.20
Transportation equipment manufacturing	3363	Motor vehicle parts manufacturing	1,440,169	377,148	23.8	31.2	.791	.896	-.37
Service-providing									
Ambulatory health care services	6216	Home health care services	1,581,985	422,541	78.3	88.4	.755	.517	.95
Nursing and residential care facilities	6231	Nursing care facilities	1,922,384	1,290,829	82.2	85.2	.675	.604	.87
Professional, scientific, and technical services	5413	Architectural, engineering, and related services	3,051,639	594,489	42.0	27.9	.982	.854	.72
Administrative and support services	5616	Investigation and security services	2,593,065	508,658	45.7	28.0	.995	.856	.67
Professional, scientific, and technical services	5415	Computer systems design and related services	3,051,639	633,428	42.0	33.2	.982	.917	.39

Table 4. Continued—Highest and lowest contributions to H within NAICS three-digit industries and between NAICS four-digits industries, 2008

Domain and three-digit industry	Four-digit industry		Number of employees		Percent women		E		Percentage of H
	Code	Title	Within industry	Between industries	Within industry	Between industries	Within industry	Between industry	
Nursing and residential care facilities	6233	Community care facilities for the elderly	1,922,384	309,954	82.2	79.5	0.675	0.732	-0.17
Social assistance	6243	Vocational rehabilitation services	637,811	165,593	72.0	58.6	.855	.978	-.19
Nursing and residential care facilities	6239	Other residential care facilities	1,922,384	184,749	82.2	74.4	.675	.820	-.25
Nursing and residential care facilities	6232	Residential mental retardation, mental health, and substance abuse facilities	1,922,384	136,852	82.2	70.7	.675	.873	-.26
Ambulatory health care services	6219	Other ambulatory health care services	1,581,985	278,297	78.3	66.4	.755	.921	-.44

SOURCE: North American Industry Classification System; National Survey of Private Employers.

percentages of women in jobs are in the single digits, with six industries registering less than 2.0 percent (for instance, the 1.5-percent female craftworkers employed by building equipment contractors, NAICS code 2382, table 6).

By contrast, the positive outliers for clerical workers represent a job group with a preponderance of female employees, often in industries with a preponderance of female employees. All but one of the NAICS four-digit industries listed in table 8 have a majority of female employees. The percentage of female employees in industries shown in the table ranges from 44.1 percent in management, scientific, and technical consulting services (NAICS code 5416) to 85.2 percent in nursing care facilities (6231). The median percentage of women in the industries shown is 62.8 percent. Unlike the percentages of women in craft and operative jobs, the percentages in clerical jobs are larger than the industry percentages, sometimes substantially. The percentage of female employees in clerical jobs ranges from 71.3 percent in business support services (NAICS code 5614) to 93.6 percent in offices of physicians (6211). The median percentage of women in the clerical jobs shown in table 8 is 82.0 percent. As an example of the relative overrepresentation of women in clerical jobs in an industry, general medical and surgical hospitals (NAICS code 6221) have 79.3 percent female employees and, of all clerical workers in the industry, 91.6 percent are women. Note also that general medical and surgical hospitals have a large percentage of H:

2.2 percent, compared with the median percentage of H of 0.24 percent for the clerical jobs shown in table 8.²⁰

Taken as a group, the craft, operative, and clerical jobs suggest a common pattern: they are industries of low gender diversity in which certain jobs have even less gender

Table 5. Contributions to H between EEOC job groups within NAICS four-digit industries, 2008

EEOC job group	Percentage of H from—		Total percentage of H
	Goods-producing domain	Service-providing domain	
Total between-jobs percentage of H	11.19	24.12	35.31
Upper management	.47	.25	.72
Midlevel management	1.06	-.06	1.01
Professional	-.30	1.79	1.49
Technical	.82	1.20	2.01
Sales	.15	1.19	1.33
Clerical	.08	9.92	10.00
Craft	7.09	4.56	11.65
Operative	1.53	4.22	5.75
Laborer	.36	1.24	1.59
Service	-.05	-.18	-.23

SOURCE: North American Industry Classification System; National Survey of Private Employers.

Table 6. Contributions to *H* within NAICS four-digit industries and between EEO-1 job groups: 15 highest percentages of *H* indicating least diverse craft jobs, 2008

Rank	NAICS domain	NAICS four-digit industry		Number of employees		Percent women		<i>E</i>		Percentage of <i>H</i>
		Code	Title	Craft	Total	Craft	Total	Craft	Total	
1	Service providing	2211	Electric power generation, transmission, and distribution	109,894	422,625	2.9	24.8	0.189	0.808	0.642
2	Goods producing	2362	Nonresidential building construction	127,341	328,115	1.8	12.2	.129	.536	.489
3	Goods producing	2389	Other specialty trade contractors	163,170	345,818	1.8	8.3	.130	.414	.438
4	Goods producing	2382	Building equipment contractors	103,595	202,719	1.5	9.6	.113	.457	.337
5	Service providing	4411	Automobile dealers	51,708	352,156	2.1	19.9	.149	.719	.279
6	Goods producing	3364	Aerospace product and parts manufacturing	96,771	490,580	11.2	23.8	.506	.791	.261
7	Service providing	4811	Scheduled air transportation	54,889	444,382	10.7	41.5	.491	.979	.253
8	Service providing	5617	Services to buildings and dwellings	36,766	480,641	3.9	38.1	.239	.959	.250
9	Goods producing	3329	Other fabricated metal product manufacturing	55,034	298,728	7.7	25.1	.391	.812	.219
10	Goods producing	3261	Plastics product manufacturing	53,273	409,256	10.8	34.0	.495	.924	.216
11	Service providing	5171	Wired telecommunications carriers	47,437	220,122	12.7	42.8	.550	.985	.195
12	Service providing	4821	Rail transportation	92,030	186,157	2.8	8.1	.184	.405	.192
13	Service providing	5413	Architectural, engineering, and related services	30,551	594,489	4.7	27.9	.271	.854	.168
14	Goods producing	2131	Support activities for mining	43,466	209,407	1.9	12.4	.135	.542	.167
15	Goods producing	3363	Motor vehicle parts manufacturing	41,256	377,148	10.0	31.2	.468	.896	.167

SOURCE: North American Industry Classification System; National Survey of Private Employers.

diversity. Rather than reflecting the industry as a whole, these jobs contribute to overall gender segregation because they have proportionately more men in male-dominated industries and proportionately more women in female-dominated industries.

THE OVERALL *H* INDEX FOUND IN THIS STUDY, 0.2170 (see tabulation on p. 39), indicates that NAICS industries and Equal Employment Opportunity Commission job groups in the 2008 EEO-1 survey are about one-fifth more gender segregated (less gender diverse) than the total reported workforce. Readers should interpret these results

cautiously, however. The EEO-1 survey uses broad job categories, such as professionals and salesworkers. It is possible that more occupational-based data will reveal higher levels of gender segregation in U.S. labor markets.²¹ The survey also excludes establishments with fewer than 100 employees (or, in some cases, fewer than 50 employees). It is possible that increasing the number of observations from industries with many small firms, such as industries in agriculture and construction, would increase the value of the *H* index. Note, too, that the *H* index measures gender diversity resulting from either a predominance of men or a predominance of women. It does not, by itself, tell which

Table 7. Contributions to *H* within NAICS four-digits industries and between EEO-1 job groups: 15 highest percentages of *H* indicating least diverse operative jobs, 2008

Rank	NAICS domain	NAICS four-digit industry		Number of employees		Percent women		<i>E</i>		Percentage of <i>H</i>
		Code	Title	Operative	Total	Operative	Total	Operative	Total	
1	Service providing	4841	General freight trucking	256,892	461,073	5.0	13.8	0.287	0.579	0.710
2	Service providing	4244	Grocery and related product merchant wholesalers	97,446	318,026	7.8	24.7	.397	.806	.377
3	Service providing	4921	Couriers and express delivery services	142,242	426,277	9.7	20.6	.459	.734	.370
4	Service providing	4441	Building material and supplies dealers	62,734	662,819	11.0	37.1	.499	.951	.268
5	Service providing	4842	Specialized freight trucking	65,711	120,081	4.5	15.7	.263	.628	.227
6	Service providing	4811	Scheduled air transportation	52,835	444,382	14.5	41.5	.597	.979	.191
7	Goods producing	3121	Beverage manufacturing	63,299	218,046	8.3	19.8	.413	.718	.183
8	Goods producing	2131	Support activities for mining	43,887	209,407	1.8	12.4	.133	.542	.170
9	Service providing	5622	Waste treatment and disposal	32,584	71,929	1.8	17.2	.130	.662	.164
10	Service providing	4931	Warehousing and storage	87,202	294,968	23.4	35.8	.785	.941	.129
11	Service providing	2211	Electric power generation, transmission, and distribution	29,681	422,625	7.6	24.8	.386	.808	.118
12	Service providing	4451	Grocery stores	105,024	2,020,551	30.6	49.8	.888	1.000	.111
13	Service providing	4248	Beer, wine, and distilled alcoholic beverage merchant wholesalers	20,902	100,144	2.0	17.0	.141	.658	.102
14	Goods producing	3251	Basic chemical manufacturing	30,650	152,424	8.9	22.6	.432	.772	.098
15	Goods producing	2389	Other specialty trade contractors	41,361	345,818	2.7	8.3	.180	.414	.092

SOURCE: North American Industry Classification System; National Survey of Private Employers.

gender is in the minority, men or women. In addition, the *H* index is the sum of weighted proportions. Within industries, *H* assigns greater weight to larger industries than smaller industries and greater weight to industries with low segregation levels than industries with high segregation levels. Thus, while providing a useful view of the overall workforce, it underestimates the impact of small industries with extreme gender disparities.

Within these limitations, it is evident that there is

substantial variation in gender diversity among the NAICS categories and the EEO-1 job groups. This article has examined three types of variation: that between NAICS domains, that between NAICS subcategories within NAICS domains, and that between EEO-1 job groups within NAICS four-digit industries. The largest contribution to overall gender segregation can be attributed to the NAICS subcategories (45.0 percent), followed by the EEO-1 job groups (35.3 percent) and the

Table 8. Contributions to *H* within NAICS four-digit industries and between EEO-1 job groups: 15 highest percentages of *H* indicating least diverse clerical jobs, 2008

Rank	NAICS domain	NAICS four-digit industry		Number of employees		Percent women		<i>E</i>		Percentage of <i>H</i>
		Code	Title	Clerical	Total	Clerical	Total	Clerical	Total	
1	Service providing	6221	General medical and surgical hospitals	721,951	4,509,841	91.6	79.3	0.417	0.735	2.171
2	Service providing	5241	Insurance carriers	408,481	1,107,938	82.1	65.2	.678	.932	.980
3	Service providing	5221	Depository credit intermediation	462,682	954,374	77.9	62.8	.761	.952	.834
4	Service providing	6211	Offices of physicians	146,773	471,819	93.6	79.3	.344	.735	.543
5	Service providing	5411	Legal services	150,978	317,440	82.0	61.3	.679	.963	.405
6	Service providing	5242	Agencies, brokerages, and other insurance related activities	140,107	356,083	80.2	62.7	.718	.953	.312
7	Service providing	5511	Management of companies and enterprises	105,681	454,706	79.0	50.2	.741	1.000	.259
8	Service providing	5614	Business support services	221,435	545,225	71.3	58.6	.865	.978	.238
9	Service providing	4521	Department stores	85,861	1,263,900	84.9	69.3	.613	.889	.225
10	Service providing	6219	Other ambulatory health care services	57,264	278,297	85.7	66.4	.591	.921	.179
11	Service providing	7211	Traveler accommodation	105,140	1,017,003	73.9	51.2	.828	1.000	.171
12	Service providing	6231	Nursing care facilities	72,692	1,290,829	92.7	85.2	.378	.604	.155
13	Service providing	5111	Newspaper, periodical, book, and directory publishers	74,253	439,989	76.0	50.9	.794	1.000	.144
14	Service providing	5416	Management, scientific, and technical consulting services	61,520	386,003	78.8	44.1	.745	.990	.143
15	Service providing	6214	Outpatient care centers	47,476	229,116	89.4	77.1	.486	.776	.130

SOURCE: North American Industry Classification System; National Survey of Private Employers.

NAICS domains (19.7 percent). It is evident that many industries make only minimal contributions to overall gender segregation while a few NAICS categories, such as the goods-producing domain and health care industries within the service-providing domain, make major contributions to overall gender segregation (18.2 percent and 21.6 percent, respectively). It is also evident that traditional craft, operative, and clerical jobs still matter. Taken together, craft, operative, and clerical job groups account for about three-fourths of the differences in

gender segregation levels between job groups.

Future research should be able to expand on the findings of this study by exploring variations in employment segregation by race and ethnic group, as well as variations in employment segregation at the level of individual firms and establishments. Future research should also consider the implications of employment segregation for studies of gender pay rates. It is quite possible, for example, that gender segregation raises or lowers wages in an industry in addition to creating pay disparities between men and women. □

Notes

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¹ Officially known as Standard Form 100, Employer Information Report EEO-1.

² The concept of segregation is used here in the tradition of social science studies, which measure degrees of concentration by a particular group. It is not intended to represent situations in which one group is entirely excluded from jobs or employment opportunities.

³ For an extensive review of research prior to 2000, see Astrid Kunze, "The Determination of Wages and the Gender Wage Gap: A Survey," Discussion Paper No. 193 (Bonn, Germany, Institute for the Study of Labor, August 2000), <http://ssrn.com/abstract=251995>.

⁴ See Kimberly Bayard, Judith Hellerstein, David Neumark, and Kenneth Troske, "New Evidence on Sex Segregation and Sex Differences in Wages from Matched Employee-Employer Data," *Journal of Labor Economics*, October 2003, pp. 887-922.

⁵ *North American Industry Classification System: United States, 2007* (Executive Office of the President, Office of Management and Budget, 2007).

⁶ Private employers required to file are (a) those with 100 or more employees and (b) those with 50 or more employees and which (1) have a federal contract or first-tier subcontract worth \$50,000 or more, or (2) act as depositories of federal funds in any amount, or (3) act as issuing and paying agents for U.S. Savings Bonds and Notes. Single-establishment employers submit only one EEO-1 report, while those employers whose business was conducted at more than one location submit a companywide consolidated report, a headquarters report, and individual reports for each establishment with 50 or more employees. Employment figures may be reported for any pay period in the third quarter (July through September). Given these eligibility requirements, industries composed largely of small establishments, such as the agriculture and construction industries, tend to be underrepresented in the survey.

⁷ For more details, see "Job Patterns For Minorities And Women In Private Industry (EEO-1)" (U.S. Equal Employment Opportunity Commission, no date), <http://www.eeoc.gov/eeoc/statistics/employment/jobpat-eeo1/index.cfm>.

⁸ See EEO-1 instruction booklet, "EEO-1 Terms Applicable to All Reporting Formats," section 5, "Description of Job categories," <http://www.eeoc.gov/employers/eeo1survey/2007instructions.cfm>.

⁹ The Equal Employment Opportunity Commission obtains and maintains EEO-1 reports pursuant to its authority under section 709, Title VII, of the Civil Rights Act of 1964, as amended, 42 U.S.C. 2000e-8. Paragraph (e) of that section prohibits the Commission and its employees from disclosing EEO-1 reports to the public. Violation of the prohibition is punishable by fine and imprisonment. Aggregated data are available to the public.

¹⁰ The coding of NAICS domains and sectors is based on "BLS Standard for Sector Aggregation Titles for NAICS" (U.S. Bureau of Labor Sta-

tistics, Oct. 20, 2008), http://www.bls.gov/bls/naics_aggregation.htm. (For background on NAICS classifications, see Teresa L. Morisi, "Recent changes in the national Current Employment Statistics survey," *Monthly Labor Review*, June 2003, pp. 3-13, <http://www.bls.gov/opub/mlr/2003/06/art1full.pdf>; Carole A. Ambler and James E. Kristoff, "Introducing the North American Industry Classification System," *Government Information Quarterly*, vol. 15, no. 3, 1998, pp. 263-273; and John Murphy, "Introducing the North American Industry Classification System," *Monthly Labor Review*, July 1998, pp. 43-47, <http://www.bls.gov/opub/mlr/1998/07/rpt1full.pdf>.)

Excluded from the discussion that follows is the public administration sector (NAICS codes 921 and above). Also excluded are NAICS four-digit industries occupying the lower 5 percent of one or more of three size measures (industries with fewer than 15 companies, fewer than 27 individual establishments, or fewer than 4,841 total employees). This requirement eliminated such industries as cattle ranching (NAICS 1121), forest nurseries (1132), fishing (1141), water sightseeing transportation (4872), lessors of nonfinancial intangible assets (5331), and RV (recreational vehicle) parks (7212). Several other four-digit industries, such as timber tract operations (NAICS 1131) and local messengers (4922) were eliminated because they violated Equal Employment Opportunity Commission disclosure rules. (Specifically, a single employer had 80 percent or more of the employees in the industry.)

¹¹ To obtain an upper limit of 1.0, the entropy index E is adjusted, or normalized, to reflect the number M of groups. In the case of gender inequality, there are two groups and the adjustment factor is the natural logarithm of 2, or, mathematically, $\ln(2)$. For example, for women,

$$E = W \times \left[\frac{\ln(1/W)}{\ln(2)} \right],$$

where W denotes the proportion of women (in an occupation, an industry, a job group, or, in general, any kind of population). Thus, if $W = 0.5$, then $\ln(1/.05) = 0.6931 = \ln(2)$, and it follows that $E = 0.5$, or, in words, the contribution to E for women is 0.5. (See the appendix for a fuller discussion of E .)

¹² Note that $\ln(1/0)$, which is normally undefined, is defined as 0 in this case. Thus, when the proportion of women is 0.0, the value of E for women is $(0) \times [\ln(1/0)] = 0.0$, the value of E for men is $(1) \times (\ln(1/1)) = 0.0$, and the total value of E is 0.0.

¹³ When the proportion of women is 0.5, the value of E for women is $(.5) \times (\ln(2(1/.5))) = 0.5$, the value of E for men is also $(.5) \times (\ln(2(1/.5))) = 0.5$, and the total value of E is 1.0.

¹⁴ See Sean F. Reardon and Glenn Firebaugh, "Measures of Multigroup Segregation," *Sociological Methodology*, vol. 32, no. 1, 2002, pp. 33-67, quote from p. 45.

¹⁵ For a proof of the decomposition of H , based on its relationship to the likelihood-ratio chi-squared statistic (G^2), see Sean F. Reardon, John T. Yun, and Tamela McNulty Eitle, "The Changing Structure of School Segregation: Measurement and Evidence of Multiracial Metropolitan-Area School Segregation, 1989-1995," *Demography*, August 2000, pp. 351-364, especially p. 363. For a discussion of within and between measures, see Reardon and Firebaugh, "Measures of Multigroup Segregation," p. 55; and Reardon, Yun, and Eitle, "The Changing Structure of School Segregation," p. 355.

¹⁶ Hereafter, the phrase "contributions to gender segregation" will be used to describe components of H that vary by job and industry. Recall that the word "segregation" in this context refers to the degree of

gender concentration (that is, the opposite of gender diversity), rather than the concept of total exclusion common in legal discussions.

¹⁷ For NAICS sectors within these two domains, see table 2.

¹⁸ Recall that the eligibility requirements for participation in the EEO-1 survey tend to underestimate the number of employees in industries, such as agriculture, with many small establishments.

¹⁹ Not shown in either table 3 or table 4. The H statistics cited represent the values calculated between the 10th and 90th deciles of the overall H distributions; by contrast, tables 3 and 4 list only the indus-

tries with the highest and lowest contributions to H .

²⁰ The general medical and surgical hospitals industry is also an outlier in the professional job group, with an industry percentage of 79.3 percent women, a job group percentage of 83.3 percent women, and a percentage of H of 1.5 percent.

²¹ See Kim A. Weeden and Jesper B. Sorensen, "A Framework for Analyzing Industrial and Occupational Sex Segregation in the United States," in Maria Charles and David B. Grusky, *Occupational Ghettos: The Worldwide Segregation of Women and Men* (Stanford, CA, Stanford University Press, 2004), pp. 245-294.

APPENDIX: Formulas for segregation indexes

The E index, known as Theil's entropy index, is a measure of inequality or diversity expressed by the formula

$$E = \sum_{m=1}^M \pi_m \ln(1/\pi_m),$$

where M is the number of groups and π is the proportion of persons in a particular group. Theil's H index,

$$H = \sum_{u=1}^U \left(\frac{t_u}{T}\right) \left(\frac{E - E_u}{E}\right),$$

is a sum of weighted proportions, where U is the number of organizational units (such as industries or job groups), t_u is the number of persons in the unit, T is the number of persons in the population, E is the population diversity index, and E_u is the unit diversity index.

With the subscript i denoting industries and j EEO-1 job groups, within and between relationships can be expressed as

Overall H = HB (value of H between industries) +
 HW (value of H within industries and
 between jobs),

or, more mathematically,

$$\sum_{i=1}^I \sum_{j=1}^J \left(\frac{t_{ij}}{T}\right) \left(\frac{E - E_{ij}}{E}\right) = \sum_{i=1}^I \left(\frac{t_i}{T}\right) \left(\frac{E - E_i}{E}\right) + \sum_{i=1}^I \sum_{j=1}^J \left(\frac{t_{ij}}{T}\right) \left(\frac{E_i - E_{ij}}{E}\right).$$

The HW index, the last term on the right, can also be expressed as

$$HW = \sum_{i=1}^I \sum_{j=1}^J \frac{t_i E_i}{TE} \left(\frac{t_{ij}}{t_i}\right) \frac{(E_i - E_{ij})}{E_i}.$$

This equation underscores several important characteristics of HW indexes. Because HW is directly related to t_i/T , the relative size of an industry contributes to HW. With other relationships held constant, larger industries affect the magnitude of HW more than smaller industries do. Likewise, E_i/E is directly related to HW. Again with other relationships held constant, integrated industries affect the magnitude of HW more than segregated industries do. That is, more diverse industries increase the value of HW, and less diverse industries decrease the value of HW.